Next Generation Nuclear Power with Hydrogen Production
Conceptual Design Studies Phase B

Project Quality Assurance Plan

Contract Number(s):	01910.00.00005
Safety Classification:	Non-Safety
Customer and Site Name:	Battelle Energy Alliance LLC, at the Idaho National Laboratory
Issue Date:	August 1, 2008

Project QA Plan Approvals

	Printed/Typed Name	Signature	Date
Originator:	W. J. DeCooman	W. J. DeCooman	July 30, 2008
Project Manager:	W. J. Anderson		7/31/08
Project Manager NP:	F. H. Southworth	F. H. Southworth	Aug. 12, 2008
QA Manager	J. M. Ebner	J. M. Ebner	08/12/2008
Vice President, Projects	T. A. Coleman	T. A. Coleman	08/06/08

Distribution List:

VP Projects	T. A. Coleman
Project Manager	W. J. Anderson
Project Manager (NP)	F. H. Southworth
Project Engineer (NP)	L. J. Lommers
Project QA	J. M. Ebner
NGNP CDS Ph B	Project File

Section I – Project General Information

1. Client Name: Battelle Energy Alliance, LLC. (BEA)
2. Project Title: Next Generation Nuclear Power with Hydrogen Production, Conceptual Design Studies - Phase B
3. Procurement Documents (contracts, work orders, agreements, etc.) including Dates/Revisions:
   BEA – Blanket Master Contract Number: 00075310; Statement of Work Doc. Id. SOW-6306, Rev.1, Effective 05/07/08, Project No. 23843 Date: April 24, 2008
4. Safety Class: ☐ Safety Significant ☐ General Service ☒ Other Non–Safety
5. Customer QA Level: Not Specified

6. Code or Standard: ASME NQA-1-2000		7. Start Date: June, 2008
		Est. Comp. Date: Sept. 30, 2008

8. AREVA NP Quality Levels: Non-Nuclear Safety

Section II – Project Description

9. Project Description:

During the Department of Energy's Next Generation Nuclear Plants (NGNP) Pre-Conceptual Design (PCD) work phase, including the several review meetings held between Idaho National Laboratory, Management & Operating Contractor, Battelle Energy Alliance, LLC (INL, M&O, BEA) NGNP Project Engineering and the subcontractor teams, several areas were identified for emphasis and further study in the conceptual design phase of design development. These were captured by the contractor teams and presented as recommended future studies in the PCD Reviews. NGNP Project Engineering extracted all of the recommended future studies from the reports for review and eventual incorporation into the conceptual design work scope. Approximately 100 study descriptions were extracted. In many cases, the subject, scope, and objectives of several studies were similar enough to permit consolidating them into a single study. This consolidation effort distilled the number of studies by about half (i.e., there are now about 50 uniquely defined future studies). NGNP Project Engineering then separated the studies into three categories:

Technical Selection Studies – These studies need to be completed to support the selection of key parameters and technologies for the NGNP (e.g., reactor power, gas outlet temperature, IHX design and materials, RPV materials, and hydrogen plant). These have the highest priority since these decisions need to be made to begin the actual design of the plant.

Design Development Studies – These studies address areas that will affect the actual design of the plant and critical systems and components (e.g., site selection within INL, design to facilitate construction, and design to support the initial proof-of-principle operating period). These have high priority since these areas need to be resolved to begin the actual design work.

Other Studies – These studies cannot be initiated until the other higher-priority studies are completed since the nature of the study depends on the results of the prior studies and design selections.

The AREVA work plan is formulated to provide engineering services for the conceptual design activities for NGNP with high efficiency electricity production and process heat applications including a hydrogen production facility and is derived from the BEA Statement of Work (SOW 6175) that will initiate the conceptual design work to support the selection of key parameters and technologies for the NGNP.

AREVA has the overall project responsibility. Other key technical competencies needed for full execution of this and follow-on phases of the NGNP including final design, construction and operations work have been assembled within the AREVA NGNP Team that include Burns & Roe, Washington Group International, BWXT, Dominion Engineering, Praxair, Hamilton Sundstrand-Rocketdyne and Mitsubishi Heavy Industries (MHI).

AREVA NGNP Team members were selected to bring key technical competencies for the successful execution and completion of the pre-conceptual, conceptual and follow-on phases of this project. AREVA NGNP team members bring relevant experience and/or on-going R&D work needed to perform the conceptual design being proposed. This work plan capitalizes on the team members existing and ongoing R&D work to produce a high value conceptual design for the NGNP prototype facility. This will be executed within the constraints of strict and aggressive project schedule and project management principles.

10. Plan Sections/Attachments: (☒ *Applicable to the project and included as part of this PQAP)*

Topic	As a Plan Section	Number	As a Plan Attachment	Designator	Rev.
Project General Information	☒	I	☐		
Project Description	☒	II	☐		
AREVA Procedures	☒	III	☐		
Client Procedures *(NA)*	☐	IV	☐		
Other Procedures *(NA)*	☐	V	☐		
External and Internal Interfaces	☒	VI	☐		
Interface Controls	☒	VII	☐		
Scope of Work	☒	VIII	☐		
Training Requirements	☒	IX	☐		
Deliverables List	☒	X	☐		
Computer Software List	☒	XI	☐		
BEA/AREVA Statement of Work	☐		☒	Attachment A	4/24/08

Section III – AREVA QA Procedures *(Latest revision is in effect when work is performed)*

11. Indicate the AREVA QA Procedures that apply to the project: (List the procedure number adjacent to the b*oxes checked yes*)

(Applicable Sections of NQA-1 Part 1 Requirements)

Procedure Function	Applicability	Implementation Procedure
1. Organization		
100 – Basic	☒ Yes ☐ No	AFS-QA-PMD-001, AFS-QA-PRC-1.1
200 – Structure and Responsibility	☒ Yes ☐ No	AFS-QA-PMD-001, AFS-QA-PRC-1.1
300 – Interface Control	☒ Yes ☐ No	AFS-PM-PRC-001
2. Quality Assurance Program		
100 – Basic	☒ Yes ☐ No	AFS-QA-PMD-001, AFS-QA-PRC-2.1
200 – Indoctrination and Training	☒ Yes ☐ No	AFS-TR-PRC-001
300 – Qualification Requirements	☒ Yes ☐ No	AFS-QA-PRC-2.2, AFS-QA-PRC-2.3
400 – Certification of Qualification	☒ Yes ☐ No	AFS-QA-PRC-2.2, AFS-QA-PRC-2.3
500 – Records	☒ Yes ☐ No	AFS-RM-PRC-001
3. Design Control		
100 – Basic	☒ Yes ☐ No	AFS-EN-PRC-001
200 – Design Input	☒ Yes ☐ No	AFS-EN-PRC-001
300 – Design Process	☒ Yes ☐ No	AFS-EN-PRC-001
400 – Design Analysis	☒ Yes ☐ No	AFS-EN-PRC-001, AFS-EN-PRC-002
500 – Design Verification	☒ Yes ☐ No	AFS-EN-PRC-001
600 – Change Control	☒ Yes ☐ No	AFS-EN-PRC-001, AFS-EN-PRC-005
700 – Interface Control	☒ Yes ☐ No	AFS-EN-PRC-001, AFS-PM-PRC-001

800 – Software Design Control	☒ Yes	☐ No	AFS-EN-PRC-001
900 – Documentation and Records	☒ Yes	☐ No	AFS-RM-PRC-001
4. Procurement Document Control			
100 – Basic	☒ Yes	☐ No	AFS-PR-PRC-001
200 – Control of Procurement Documents	☒ Yes	☐ No	AFS-PR-PRC-001
300 – Procurement Document Review	☒ Yes	☐ No	AFS-PR-PRC-001, AFS-PR-PRC-002
400 – Procurement Document Changes	☒ Yes	☐ No	AFS-PR-PRC-001, AFS-PR-PRC-002
5. Instructions, Procedures, and Drawings			
100 – Basic	☒ Yes	☐ No	AFS-AD-PRC-001
6. Document Control			
100 – Basic	☒ Yes	☐ No	AFS-AD-PRC-001
200 – Document Control	☒ Yes	☐ No	AFS-AD-PRC-001
300 – Document Changes	☒ Yes	☐ No	AFS-AD-PRC-001
7. Control of Purchased Items and Services			
100 – Basic	☒ Yes	☐ No	AFS-QA-PRC-7.1
200 – Supplier Evaluation and Selection	☒ Yes	☐ No	AFS-QA-PRC-7.2, AFS-QA-PRC-7.3, AFS-QA-PRC-7.4, AFS-QA-PRC-7.5
300 – Bid Evaluation	☒ Yes	☐ No	AFS-QA-PRC-7.1
400 – Control of Supplier Generated Documents	☒ Yes	☐ No	AFS-EN-PRC-012
500 – Acceptance of Item or Service	☒ Yes	☐ No	AFS-QA-PRC-7.7, AFS-QA-PRC-7.9
600 – Control of Supplier Nonconformances	☒ Yes	☐ No	AFS-QA-PRC-15.1
700 – Commercial Grade Items	☒ Yes	☐ No	AFS-EN-PRC-007
8. Identification and Control of Items			
100 – Basic	☒ Yes	☐ No	AFS-EN-PRC-008
200 – Identification Methods	☐ Yes	☒ No	N/A
300 – Specific Requirements	☐ Yes	☒ No	N/A
9. Control of Processes			
100 – Basic	☐ Yes	☒ No	N/A
200 – Process Control	☐ Yes	☒ No	N/A
300 – Responsibility	☐ Yes	☒ No	N/A
400 – Records	☐ Yes	☒ No	N/A
10. Inspection			
100 – Basic	☐ Yes	☒ No	N/A
200 – Inspection Requirements	☐ Yes	☒ No	N/A
300 – Inspection Hold Points	☐ Yes	☒ No	N/A
400 – Inspection Planning	☐ Yes	☒ No	N/A
500 – In-process Inspection	☐ Yes	☒ No	N/A
600 – Final Inspection	☐ Yes	☒ No	N/A
700 – Records	☐ Yes	☒ No	N/A
11. Test Control			
100 – Basic	☒ Yes	☐ No	AFS-EN-PRC-010

200 – Test Requirements	☒	Yes	☐	No	AFS-EN-PRC-010
300 – Test Procedures (Other than for Computer Programs	☒	Yes	☐	No	AFS-EN-PRC-010
400 – Computer Program Test Procedures	☒	Yes	☐	No	AFS-EN-PRC-006
500 – Test Results	☒	Yes	☐	No	AFS-EN-PRC-010
600 – Test Records	☒	Yes	☐	No	AFS-EN-PRC-010
12. Control of Measuring and Test Equipment					
100 – Basic	☒	Yes	☐	No	AFS-EN-PRC-011
200 – Selection	☐	Yes	☒	No	N/A
300 – Calibration and Control	☐	Yes	☒	No	N/A
400 – Records	☐	Yes	☒	No	N/A
13. Handling, Storage and Shipping					
100 – Basic	☐	Yes	☒	No	N/A
200 – Special Requirements	☐	Yes	☒	No	N/A
300 – Procedures	☐	Yes	☒	No	N/A
400 – Tools and Equipment	☐	Yes	☒	No	N/A
500 – Operations	☐	Yes	☒	No	N/A
600 – Marking and Labeling	☐	Yes	☒	No	N/A
14. Inspection, Test and Operating Status					
100 – Basic	☐	Yes	☒	No	N/A
15. Control of Nonconforming Items					
100 – Basic	☒	Yes	☐	No	AFS-QA-PRC-15.1, AFS-QA-PRC-15.2
200 – Identification	☒	Yes	☐	No	AFS-QA-PRC-15.1, AFS-QA-PRC-15.2
300 – Segregation	☐	Yes	☒	No	N/A
400 – Disposition	☒	Yes	☐	No	AFS-QA-PRC-15.1, AFS-QA-PRC-15.2
16. Corrective Action					
100 – Basic	☒	Yes	☐	No	AFS-QA-PRC-16.1
17. Quality Assurance Records					
100 – Basic	☒	Yes	☐	No	AFS-RM-PRC-001
200 – Generation of Records	☒	Yes	☐	No	AFS-RM-PRC-001
300 – Authentication of Records	☒	Yes	☐	No	AFS-RM-PRC-001
400 – Classification	☒	Yes	☐	No	AFS-RM-PRC-001
500 – Receipt Control and Retention of Records	☒	Yes	☐	No	AFS-RM-PRC-001
600 – Storage	☒	Yes	☐	No	AFS-RM-PRC-001
700 – Disposition	☒	Yes	☐	No	AFS-RM-PRC-001
800 – Maintenance of Records	☒	Yes	☐	No	AFS-RM-PRC-001
18. Audits					
100 – Basic	☒	Yes	☐	No	AFS-QA-PRC-18.1
200 – Scheduling	☒	Yes	☐	No	AFS-QA-PRC-18.1
300 – Preparation	☒	Yes	☐	No	AFS-QA-PRC-18.1
400 – Performance	☒	Yes	☐	No	AFS-QA-PRC-18.1

500 – Reporting	☒	Yes	☐	No	AFS-QA-PRC-18.1
600 – Response	☒	Yes	☐	No	AFS-QA-PRC-18.1
700 – Follow-up	☒	Yes	☐	No	AFS-QA-PRC-18.1

12. Indicate the AREVA QA Procedures that apply to the project: (List the procedure number adjacent to the *boxes checked yes*)

(Applicable Sections of NQA-1 Subpart 2.7)

Procedure Function	Applicability				Implementation Procedure
1. General					
101 – Software Engineering	☒	Yes	☐	No	AFS-EN-PRC-006
102 – Definitions	☐	Yes	☒	No	N/A
2. General Requirements					
201 – Documentation	☐	Yes	☒	No	N/A
202 – Review	☐	Yes	☒	No	N/A
203 – Software Configuration Management	☐	Yes	☒	No	N/A
204 – Problem Reporting and Corrective	☐	Yes	☒	No	N/A
3. Software Acquisition					
301 – Procured Software and Software Services	☒	Yes	☐	No	AFS-EN-PRC-006,
302 – Otherwise Acquired Software	☒	Yes	☐	No	AFS-EN-PRC-006
4. Software Engineering Method					
401 – Software Design Requirements	☐	Yes	☒	No	N/A
402 – Software Design	☒	Yes	☐	No	AFS-EN-PRC-006, AFS-EN-PRC-013
402.1 – Software Design Verification	☒	Yes	☐	No	AFS-EN-PRC-001, AFS-EN-PRC-006, AFS-EN-PRC-013
403 – Implementation	☒	Yes	☐	No	AFS-EN-PRC-006, AFS-EN-PRC-013
404 – Acceptance Testing	☒	Yes	☐	No	AFS-EN-PRC-001, AFS-EN-PRC-006, AFS-EN-PRC-013
405 – Operation	☒	Yes	☐	No	AFS-EN-PRC-006
406 – Maintenance	☒	Yes	☐	No	AFS-EN-PRC-006
407 – Retirement	☐	Yes	☒	No	N/A
5. Standards, Conventions, and Other Work Practices					
500 – Basic	☒	Yes	☐	No	AFS-EN-PRC-006
6. Support Software					
601 – Software Tools	☒	Yes	☐	No	AFS-EN-PRC-006
602 – System Software	☒	Yes	☐	No	AFS-EN-PRC-006

Section IV – Client Procedures / Requirements --

Number	Procedure Title	Rev	Comment
(NONE)			

Section V – Other Procedures --

Number	Procedure Title	Rev	Comment
(NONE)			

Section VI – External and Internal Interfaces

		Name	Location	
☐	Client - Project Manager	Sam Bader	Idaho Falls, ID	208-526-8929
☐	Client - Contract Administrator	Greg K. Anderson	Idaho Falls, ID	208-526-1816
☐	Client – Engineering Director	Richard Garrett	Idaho Falls, ID	208-526-1816
☐	---	---	---	---
☒	Project Manager NP (Point of Contact)	Finis H. Southworth	Lynchburg, VA	434-832-4271
☒	AFS Project Manager	William J. Anderson	Lynchburg, VA	434-832-2893
☒	Project Engineer NP	Lewis J. Lommers	Lynchburg, VA	434-382-3678
☒	QA Representative	Jerome M. Ebner	Charlotte, NC	704-805-2636
☒	Contract Administrator	L. Dean Lindeman	Lynchburg, VA	434-382-3203
☒	Project Controls - Accounting	Delores Perdue	Lynchburg, VA	434-382-3112
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Section VII – Interface Controls

BEA is the Prime Contractor for the INL NGNP program for the Department of Energy. AREVA Federal Services, LLC (AREVA) will provide, under subcontract to BEA key design studies for selection of the lead design, top level plant requirements, and to identify the necessary focused R&D to for design, build, license, and operate the prototype plant. The current Conceptual Design Studies will be completed within this framework. AREVA work on this project will be managed from corporate offices in Lynchburg, VA.

The technical interface for the project will be between the AREVA Project Manager and the BEA Project Manager, which includes items involving project approach. The AREVA Project Manager may delegate authority to act for him for approvals. This delegation will be in the form of a memo indicating the scope of the delegation and its duration. Changes to scope, budget, or schedule must be approved by the BEA Contractor Administrator and the responsible AFS Vice President.

All formal (non-electronic) correspondence between the AREVA Project Manager and any BEA project personnel shall have a copy provided to the AREVA Federal Projects Vice President. A letter number, as required by Records Management is to be included on all formal correspondence from AREVA to BEA.

Technical communications between BEA and AREVA cognizant engineers is expected and encouraged with prior knowledge of the AREVA Project Manager and the AREVA Technical Leads. Where significant items are agreed to or resolved, these communications are to be documented. Copies of the communication documentation are to be provided to the BEA Project Manager, the AREVA Project Manager, and the AREVA Technical Lead.

Programmatic items, such as cost and schedule, are not subject to the AREVA QA program.

Section VIII – Scope of Work

The Phase B initial tasks for this contract include:

1.2.1 Reactor Containment, Embedment Depth & Building Functions, (WBS. NHS.000.S02)

1.2.2 Power Conversion System Alternative and Selection Study, (WBS.PCS.000.S01)

1.2.3 (Later) Component Test Facility Initial Conceptual Design Report, (WBS. CTF.000.PCD)

1.2.4 (Later) Review Recommendations from F&OR Study, (WBS.NHS.000.S14)

1.2.5 Composites R & D Technical Issues, (WBS.HHS.000.S15)

1.2.6 (Later) Licensing Specification Development, (WBS.NHS.000.S16)

1.2.7 (Later) Circulator Design/Isolation Valves, (WBS, HTS.000.S02)

Detailed descriptions of the task work scopes are in Attachment A – AREVA Statement of Work.

Section IX – Training Requirements

All AFS project personnel will be trained in the AFSQA program and relevant procedures prior to performing project work. The most current revision of the procedure will be used to prepare project documents and perform project activities in accordance with the AFS QAPD.

TABLE - Training Requirements - Project Procedures

AREVA Procedures	Title
Contract 01910.00.00005	BEA Blanket Master Contract No. 00075310 (signed April 24 & 29, 2008), with PCN No 05-07-08.
QA-3000719	NGNP CDS - Project QA Plan
AFS-QA-PMD-001	AFS Quality Assurance Program Description
AFS-PM-POL-001	Project Management Policy
AFS-PM-PRC-001	Development of Project Plans
AFS-PM-PRC-002	Customer Order Entry Document
AFS-PM-PRC-003	Project Management Program Description & Project Management Guides Procedure
AFS-QA-POL-001	Quality Policy
AFS-QA-PRC-1.1	Delegation of Authority
AFS-QA-PRC-2.1	Quality Assurance Program Control
AFS-QA-PRC-2.5	Stop Work Order
AFS-QA-PRC-7.10	Suspect or Counterfeit Items
AFS-QA-PRC-15.1	Control of Nonconforming Items
AFS-QA-PRC-15.2	Reporting of Defects and Noncompliances Per 10CFR21 and PAAA
AFS-QA-PRC-16.1	Corrective Action Records
AFS-TR-PRC-001	Training
AFS-PC-PRC-001	Cost Estimating
AFS-PR-PPD-001	Procurement Program Description (PPD)
AFS-PR-POL-001	Procurement Policy
AFS-PR-PRC-002	Supplier Disposition Request
AFS-PR-PRC-003	Vendor Data Requirements
AFS-PR-PRC-007	Non-Competitive/Sole-Source Procurement
AFS-PR-PRC-011	Government Property Control Procedure
AFS-LL-POL-004	Contract Signing Authority
AFS-LL-POL-006	Levels of Authorization
AFS-LL-POL-008	Computer Software License Agreements
AFS-FI-PRC-005	Timekeeping
AFS-SH-PMD-001	ESH Program Description
AFS-SH-POL-001	ESH Policy
AFS-CA-POL-001	Contract Management Policy
AFS-CA-PRC-001	Contract Management
AFS-AD-GDE-001	Document Style Guide
AFS-RM-PRC-001	Records Management
AFS-EN-GDE-003	Engineering Drawing Preparation and Checking
AFS-EN-PRC-001	Design Control
AFS-EN-PRC-002	Design Analysis/Calculations
AFS-EN-PRC-003	Engineering Drawings
AFS-EN-PRC-004	Specifications
AFS-EN-PRC-005	Design Changes

AFS-EN-PRC-006	Software Development Quality Assurance
AFS-EN-PRC-007	Commercial Grade Items
AFS-EN-PRC-008	Identification of Material, Parts and Components
AFS-EN-PRC-013	Control of Software Used for Calculations and Analysis
AFS-EN-PRC-014	Classification of Components for DOE Projects
AFS-SH-PMD-001	ESH Program Description
AFS-SH-POL-001	ESH Policy
AFS-SH-PRC-001	Communication and Training
AFS-SH-PRC-016	ESH Stop Work

Section X – Deliverables

Studies	Completion Date
1. Reactor Containment, Embedment Depth, and Building Functions	September 15, 2008
2. Power Conversion System Alternatives and Selection Study	September 15, 2008
3. Component Test Facility Initial Conceptual Design Report – Draft	(Later)
4. Review Recommendations from F&OR Study	(Later)
5. Composites R&D Technical Issues	September 15, 2008
6. Licensing Specification Development	(Later)
7. Circulator Design/Isolation Valves	(Later)

Section XI – Computer Software List

TABLE – Computer Software List

Name of Software used	Version	Intended Application	Reason for selecting software
STAR CD	3.24 and 3.26	Fluid dynamics and heat transfer calculations	State-of-the-art commercial CFD code with widespread use across many industries. AREVA standard to develop thermal-hydraulic models for HTR applications.
MCNP	5	Calculation of local flux and fluence in the locations of interest (potential locations for composite materials).	Ability to model in detail the prismatic reactor internals and to tally the required specific neutron energy groups in the regions of interest.

ATTACHMENT – A
AREVA Statement of Work

(INL Doc. Id.: SOW-6306, Rev. ID. 1, Effective Date 05/07/2008;
INL/BEA Blanket Master Contract No. 00075310, Effective 04/24/2008; PCN No. 05-07-08)

Document ID: SOW-6306
Revision ID: 1
Effective Date: 05/07/2008

Statement of Work
AREVA

CONCEPTUAL DESIGN STUDIES

for the

NGNP

with

HYDROGEN PRODUCTION

Project No. 23843

The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance.

Idaho National Laboratory

CONCEPTUAL DESIGN STUDIES FOR THE NGNP WITH HYDROGEN PRODUCTION	Identifier: SOW-6306 Revision: 1 Effective Date: 05/07/08 Page: 1 of 71

NGNP	SOW		eCR Number: NA

SIGNATURES			
Typed Name Concurrence or Approval	Signature Code (Au,R,C,A,OA)	Date	Organization Discipline
	Au		
Sam Bader			NGNP Project Engineer
	R		
	R		
	C		
	A		
Richard L. Garrett			NGNP Engineering Director
	QA		
Gary Roberts			INL NGNP Quality Engineer

REVISION LOG

Rev.	Date	Affected Pages	Revision Description
0	3/21/08	All	New Document
1	4/17/08	All	Changed header and some font sizes, corrected minor typos.
1	4/17/08	SOW	1. Section 1.2.5 (10) "Review Recommendations from F&OR Study", [WBS, NHS.000.S14] To be sent to AREVA at a later Date. 2. Section 1.2.7 (12), "Licensing Specification Development", [WBS NHS.000.S16]. has been **DELETED** from the work scope. 3. (14) "Construction Techniques", [WBS,BOP.000.S03] has been **DELETED** from the work scope. 4. (15) "Circulator Design/Isolation Valves", [WBS, HTS.000.S02] has been **DELETED** from the work scope,

CONTENTS

1. SCOPE

1.1 Introduction

During the Preconceptual Design (PCD) phase, several areas were identified for emphasis and further study in the conceptual design phase of design development. These studies in some cases were identified by the contractor teams and presented as recommended future studies in the Preconceptual Design Studies Reports.

Approximately 100 study descriptions were extracted. In many cases, the subject, scope, and objectives of several studies were similar enough to permit consolidating them into a single study. This consolidation effort distilled the number of studies by about half (i.e., there are now about 50 uniquely defined future studies). NGNP Project Engineering then divided the future studies into the following three categories:

- Technical Selection Studies – These studies need to be completed to support the selection of key parameters and technologies for the NGNP (e.g., reactor power, gas outlet temperature, IHX design and materials, RPV materials, and hydrogen plant). These have the highest priority since these decisions need to be made to begin the actual design of the plant.
- Design Development Studies – These studies address areas that will affect the actual design of the plant and critical systems and components (e.g., site selection within INL, design to facilitate construction, and design to support the initial proof-of-principle operating period). These have high priority since these areas need to be resolved to begin the actual design work.
- Other Studies – These studies cannot be initiated until the other higher-priority studies are completed since the nature of the study depends on the results of the prior studies and design selections.

  Statement of Work FY 08-1 and associated Procurement Change Notices focused primarily on the Technical Selection Studies. This Statement of Work (SOW) will continue the conceptual design work described herein in support of the Design Development of the NGNP.

1.2 Work Included

The following list of Conceptual Design Development Studies is the scope of work to be accomplished under this SOW. The entire scope of work for each study is listed in detail in the Appendices as referenced.

1.2.1 (5), "Reactor Containment, Embedment Depth & Building Functions", [WBS NHS.000.S02].

See Section 10.2 Appendix B

1.2.2 **(8) "Power Conversion System Alternatives and Selection Study", [WBS.PCS.000.S01]**

See Section 10.3 Appendix C

1.2.3 **(11), "Composites R&D Technical Issues", [WBS HHS.000.S15].**

See Section 10.4 Appendix D

1.2.4 **(10) "Review Recommendations from F&OR Study", [WBS, NHS.000.S14]**

See Section 10.6 Appendix F

Note: To be sent to AREVA at a later Date.

1.3 Performance of Work

1.3.1 Work Plan

Develop and submit a draft work plan for the scope of work described in this document to complete the Conceptual Design Study/Report(s). The work plan shall detail and describe: all activities, organizational and staffing responsibilities for various tasks, work approach, manpower, activity estimates with cost proposal, subcontractor project organization and responsibilities, activity definition work sheets and summary sheets, as well as overall plans and schedules for accomplishing individual tasks, major milestones and reporting requirements (See section 1.3.2.5 "Monthly Reporting" for further requirements). The draft work plan shall include a proposed schedule for all pertinent activities. See Appendices for an example of a schedule showing a minimum level of detail for the work scope. Prepare and issue each study/report as an independent document.

BEA will review the draft work plan and provide comments within five working days of receipt. Based on the input of BEA, the subcontractor will develop a final work plan within 10 working days and conduct meetings with BEA to facilitate planning, final completion and approval of the work plan.

Note: Notice to proceed with the work will not be given until the final work plan is approved by BEA. See Attachments for AREVA Approved Work Plans.

1.3.2 General

During the execution of the work scope the subcontractor shall provide sufficient Project Management to ensure that the following are accomplished:

1.3.2.1 Schedule

Complete the Containment, Embedment Depth & Building Functions Study(s) no later than September 15, 2008. All other studies finish dates are noted in the approved AREVA work plan, see Attachment. The preliminary study activities and schedules shown in the Appendices are provided only to reflect the expected level of detail to be provided in the work plan. Note that the SOW schedule dates will be adjusted according to the approved subcontractors work plans and notice to proceed date.

The combined AREVA 90% Review for all studies listed in this SOW shall be scheduled at a location selected by AREVA. The work plan final schedule shall reflect this review date.

1.3.2.2 Kickoff Meeting

Participate in a teleconference kickoff meeting within five working days after receipt of this SOW with DOE-ID and BEA to discuss the scope of work, background information, design basis and key assumptions.

1.3.2.3 Field Inspections

Conduct field inspections as required. Understand the existing field conditions and interfaces, including existing facilities, missions and available utilities at the INL.

1.3.2.4 Status Review

Prepare a schedule for monthly and weekly teleconference status meetings with BEA and subcontractor's key personnel (Project Manager, Project Engineer and appropriate discipline lead engineers) to review status. General items for the monthly status meetings are:

- Progress to date vs. the plan,
- Recovery plan for activities behind schedule,
- Status of staffing and job hour expenditures,
- Highlight of activities in the upcoming month,
- Support required from BEA,
- Schedule concerns and issues,
- To-date costs vs. the budget, cost trends, earned value, etc.

The subcontractor may propose, for approval by BEA, alternate or standard work processes and reporting methods that meet the intent of the stated schedule and cost reporting requirements. The proposed status meeting schedule shall be submitted with the Proposal and contained in the Work Plan. Status (shown as percent complete) of the tasks identified on the Work Task Summary Sheets shall be presented at the status review meetings. Work-in-progress shall be presented for interim review by BEA at these meetings.

1.3.2.5 Monthly Reporting

The Subcontractor shall report earned value monthly according to the following schedule:

Month	Actual Costs to:	Est. Spending To:	Monthly Report Due:
April	April 30th	May 25th	May 7th
May	May 31st	June 22nd	June 9th
June	June 30th	July 20th	July 7th
July	July 31st	August 24th	August 7th
August	August 31st	September 22nd	September 8th
September	September 30th	October 23rd	October 7th
October	October 31st	November 21st	November 7th
November	November 31st	December 20th	December 8th

Example: The April monthly report is due on May 7th with actual costs and earned value to April 30th and estimated spending to May 25th.

The subcontractor's monthly report shall include the reports from the subcontractor's earned value monthly reporting system, with this information summarized in the format shown in Section 10.4 Appendix A. This information and estimated spending is required for BEA reporting into the DOE Project Information and Collection System (PICS).

1.3.2.6 Meeting Minutes and Telephone Records

Prepare meeting minutes and records of telephone conversations, between BEA and subcontractor personnel, regardless of who initiates the call. Send copies of the meeting minutes and phone call records to BEA within three working days of the meeting or call.

1.3.2.7 Action Item List

Maintain an individually numbered action item list showing responsibilities and completion dates. The list shall be updated, identified with the current date and distributed within two working days after action items are added.

1.3.2.8 Key Assumptions List

Prepare and maintain a Key Assumptions List. The list shall be updated, highlighted to denote changes, dated with the current date and distributed within two working days after adding items to the list.

1.3.2.9 Equipment Lists

Prepare equipment lists for facility and process equipment for use in cost estimate preparation. Long lead procurement items and recommended quality levels on the equipment shall be identified as applicable.

1.3.2.10 90% Review

Provide presentations and or draft Study/Report to BEA reviewers prior to the 90% review. All comments received during the review shall be documented, resolved and incorporated by the subcontractor prior to the submittal of the final Conceptual Design Study/Report. Comments and resolutions shall be documented and submitted for inclusion in the project files.

1.3.2.11 Performance Requirements

Cite and reference all key information and decisional statements or data used in the preparation of the Conceptual Design Study/Report and document quality assurance reviews and validation prior to submittal for review.

1.3.2.12 Future Actions List

Prepare a list of action items identified during the course of preparation of the study/reports that are not covered in this Scope of Work and that have not been previously identified, but which should be covered in conceptual design.

1.4 Work Excluded

None noted.

2. APPLICABLE CODES, PROCEDURES, AND REFERENCES

2.1 ASME NQA-1 2000, "Quality Assurance Requirements for Nuclear Facility Applications"

2.2 AREVA, "NGNP and Hydrogen Production Preconceptual Design Studies Report," Rev.0, July 10th, 2007

2.3 BEA, "Next Generation Nuclear Plant, Pre-Conceptual Design Report," Rev 1, November 14, 2007, INL/EXT-07-12967.

3. TECHNICAL AND FUNCTIONAL REQUIREMENTS

3.1 "Next Generation Nuclear Plant High-Level Functions and Requirements," Idaho National Engineering and Environmental Laboratory, September 2003, INEEL/EXT-03-01163, as modified by the Independent Technology Review Group (ITRG) report, "Design Features and Technology Uncertainties for the Next Generation Nuclear Plant," Independent Technology Review Group, Phil Hildebrandt, et al., April 2004.

4. ENVIRONMENTAL, SAFETY, HEALTH, AND QUALITY ASSURANCE REQUIREMENTS

4.1 Environmental

None noted.

4.2 Safety and Health

None noted.

4.3 Quality Assurance/Control

4.3.1 ASME-NQA-1-2000, Quality Assurance Requirements for Nuclear Facility Applications, is identified as the applicable Quality Assurance standard for the NGNP. The subcontractor shall implement and maintain a quality system in accordance with ASME-NQA-1-2000. The requirements of this standard will apply when invoked via individual work task. Work tasks that are governed by NQA-1 requirements will contain the statement "NQA-1 applicable Work Task" at the beginning of the work task description.

4.3.2 BEA shall perform a Supplier Evaluation of the subcontractor's quality system such that the subcontractor may be listed on the BEA Qualified Supplier List (QSL) for the types of work which may be directed on a task basis during Conceptual Design. The subcontractor shall provide support of this Supplier Evaluation, which may include on-site evaluations and audits of the subcontractor's quality system documentation, implementation, and technical capability.

4.3.3 The subcontractor shall develop a project Quality Assurance Plan that identifies work organization interfaces, how NQA-1-2000 requirements will be implemented, and a matrix list of implementing procedures. INL will review and approve this plan prior to starting the first NQA-1 applicable work task.

4.3.4 The subcontractor shall incorporate all applicable quality system requirements in the flow-down of requirements to lower-tier subcontracted design team members. This flow-down of requirements shall also be evaluated during the Supplier Evaluation discussed above.

4.3.5 The following sections of NQA-1-2000 shall be included in the subcontractor's Quality Assurance Plan:

Applicable Sections of NQA-1, Part 1 Requirements

1. Organization
   - ☒ 100 Basic
   - ☒ 200 Structure and Responsibility
   - ☒ 300 Interface Control
2. Quality Assurance Program
   - ☒ 100 Basic
   - ☒ 200 Indoctrination and Training
   - ☒ 300 Qualification Requirements
   - ☒ 400 Certification of Qualification
   - ☒ 500 Records
3. Design Control
   - ☒ 100 Basic
   - ☒ 200 Design Input
   - ☒ 300 Design Process
   - ☒ 400 Design Analysis
   - ☒ 500 Design Verification
   - ☒ 600 Change Control
   - ☒ 700 Interface Control
   - ☒ 800 Software Design Control
   - ☒ 900 Documentation and Records
4. Procurement Document Control
   - ☒ 100 Basic
   - ☒ 200 Control of Procurement Documents
   - ☒ 300 Procurement Document Review
   - ☒ 400 Procurement Document Changes
5. Instructions, Procedures, and Drawings
   - ☒ 100 Basic
6. Document Control
   - ☒ 100 Basic
   - ☒ 200 Document Control
   - ☒ 300 Document Changes
7. Control of Purchased Items and Services
   - ☒ 100 Basic
   - ☒ 200 Supplier Evaluation and Selection
   - ☒ 300 Bid Evaluation
   - ☒ 400 Control of Supplier Generated Documents
   - ☒ 500 Acceptance of Item or Service
   - ☒ 600 Control of Supplier Nonconformances
   - ☒ 700 Commercial Grade Items
8. Identification and Control of Items
   - ☒ 100 Basic
   - ☐ 200 Identification Methods
   - ☐ 300 Specific Requirements
9. Control of Processes
   - ☐ 100 Basic
   - ☐ 200 Process Control
   - ☐ 300 Responsibility
   - ☐ 400 Records
10. Inspection
    - ☐ 100 Basic
    - ☐ 200 Inspection Requirements
    - ☐ 300 Inspection Hold Points
    - ☐ 400 Inspection Planning
    - ☐ 500 In-process Inspection
    - ☐ 600 Final Inspection
    - ☐ 700 Records
11. Test Control
    - ☒ 100 Basic
    - ☒ 200 Test Requirements
    - ☒ 300 Test Procedures (Other than for Computer Programs)
    - ☒ 400 Computer Program Test Procedures
    - ☒ 500 Test Results
    - ☒ 600 Test Records
12. Control of Measuring and Test Equipment
    - ☒ 100 Basic
    - ☐ 200 Selection
    - ☐ 300 Calibration and Control
    - ☐ 400 Records
13. Handling, Storage and Shipping
    - ☐ 100 Basic
    - ☐ 200 Special Requirements
    - ☐ 300 Procedures
    - ☐ 400 Tools and Equipment
    - ☐ 500 Operations
    - ☐ 600 Marking and Labeling
14. Inspection, Test and Operating Status
    - ☐ 100 Basic
15. Control of Nonconforming Items
    - ☒ 100 Basic
    - ☒ 200 Identification
    - ☐ 300 Segregation
    - ☒ 400 Disposition
16. Corrective Action
    - ☒ 100 Basic
17. Quality Assurance Records
    - ☒ 100 Basic
    - ☒ 200 Generation of Records
    - ☒ 300 Authentication of Records
    - ☒ 400 Classification
    - ☒ 500 Receipt Control and Retention of Records
    - ☒ 600 Storage
    - ☒ 700 Disposition
    - ☒ 800 Maintenance of Records
18. Audits
    - ☒ 100 Basic
    - ☒ 200 Scheduling
    - ☒ 300 Preparation
    - ☒ 400 Performance
    - ☒ 500 Reporting
    - ☒ 600 Response
    - ☒ 700 Follow-up

Applicable Sections of NQA-1 Subpart 2.7

1. General
   - ☒ 101 Software Engineering
   - ☐ 102 Definitions

2. General Requirements
   - ☐ 201 Documentation
   - ☐ 202 Review
   - ☐ 203 Software Configuration Management
   - ☐ 204 Problem Reporting and Corrective

3. Software Acquisition
   - ☒ 301 Procured Software and Software Services
   - ☒ 302 Otherwise Acquired Software

4. Software Engineering Method
   - ☐ 401 Software Design Requirements
   - ☒ 402 Software Design
   - ☒ 402.1 Software Design Verification
   - ☒ 403 Implementation
   - ☒ 404 Acceptance Testing
   - ☒ 405 Operation
   - ☒ 406 Maintenance
   - ☐ 407 Retirement

5. Standards, Conventions, and Other Work Practices
   - ☒ 500 Basic

6. Support Software
   - ☒ 601 Software Tools
   - ☒ 602 System Software

5. RESPONSIBILITIES

See 1.3 Performance of Work above for Subcontractor responsibilities.

6. DELIVERABLE SCHEDULE

See 1.2 and 1.3 above for all schedule and scheduling requirements.

7. SUBMITTALS

See 1.2 and 1.3 above for all submittal requirements.

8. SPECIAL CONDITIONS

None specifically noted.

9. ACCEPTANCE

All deliverables will be reviewed against this SOW and the approved work plan for compliance. Deliverable content and progress will be discussed and reviewed during the weekly conference

calls and the monthly status meetings. Final comments and acceptance will be preformed during the 90% Review (see section 1.3.2.10 above for details).

10. APPENDICES

10.1 **Appendix A: SOW Section 1.3.2.5 "Monthly Reporting"**

10.2 **Appendix B: (5), "Reactor Containment, Embedment Depth & Building Functions", [WBS NHS.000.S02].**

10.3 **Appendix C: (8) "Power Conversion System Alternatives and Selection Study," [WBS.PCS.000.S01]**

10.4 **Appendix D: (11), "Composites R&D Technical Issues," [WBS HHS.000.S15].**

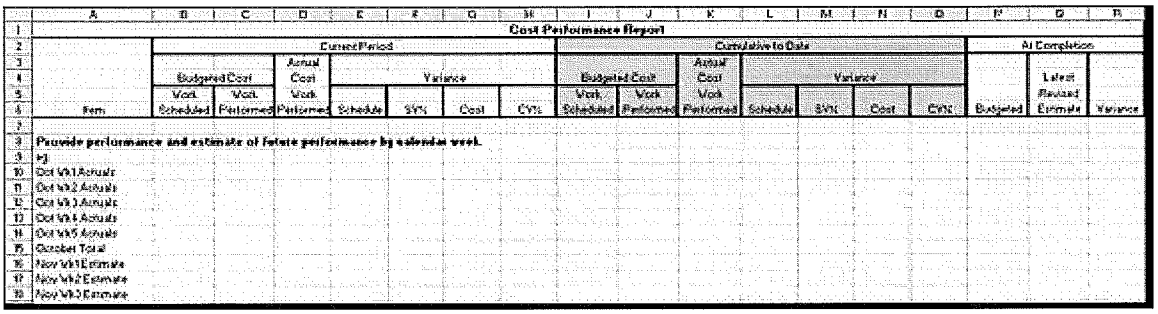
10.5 **Appendix E: (10) "Review Recommendations from F&OR Study," [WBS, NHS.000.S14] To be sent to AREVA at a later Date.**

11. ATTACHMENTS

11.1 **AREVA Approved Work Plan**

Appendix A

SOW Section 1.3.2.5 "Monthly Reporting"



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Cost Performance Report																	
2		Current Period							Cumulative to Date							At Completion		
3																		
4		Budgeted Cost		Actual Cost	Variance				Budgeted Cost		Actual Cost	Variance						
5		Work	Work	Work					Work	Work	Work						Latest	
6	Item	Scheduled	Performed	Performed	Schedule	SV%	Cost	CV%	Scheduled	Performed	Performed	Schedule	SV%	Cost	CV%	Budgeted	Revised Estimate	Variance
7																		
8	Provide performance and estimate of future performance by calendar week.																	
9	Wk																	
10	Oct Wk1 Actuals																	
11	Oct Wk2 Actuals																	
12	Oct Wk3 Actuals																	
13	Oct Wk4 Actuals																	
14	Oct Wk5 Actuals																	
15	October Total																	
16	Nov Wk1 Estimate																	
17	Nov Wk2 Estimate																	
18	Nov Wk3 Estimate																	

Appendix B

"Reactor Containment, Embedment Depth & Building Functions"

[WBS NHS.000.S02]

WBS Title:	**Reactor Containment, Embedment Depth, & Bldg Functions**
WBS Element Code Level:	**NHS.000.S02**
Activity:	
Project Engineer:	**Sam Bader**
Status	**Subcontractor Information**

1. ELEMENT DESCRIPTION:

This study will support development of the technical and functional requirements for the NGNP and HTGR containment and reactor building, including embedment. This will include consideration of:

- NRC regulations and HTGR objectives regarding design basis release rates
- NRC regulations on design basis threats and hazards
- The need for a filtered containment, and, if needed, definition of the filtration requirements

This study shall be based on the current understanding of expected source terms for the HTGR technology. As such it is understood that this will be a scoping study helping to frame the issues associated with development of the T&FRs for the containment and reactor building. Accordingly, an objective of this study is to identify the issues and further R&D and engineering studies that are required to resolve these issues.

This study will develop the requirements and criteria for the degree of embedment of the reactor building. This study will include embedment studies for the HTGR reactor building concepts, considering the interaction among factors that influence the depth of the embedment. These factors include cost, design basis threats, seismic effects, hazards resistance, etc. The results of this study will be used to characterize the interactions of these factors on embedment depths for commercial application of this technology. The recommendations from relevant sections of the Electric Power Research Institute (EPRI)'s Advanced Light Water Reactor Utility Requirements Document will be evaluated for applicability in this study. This phase of the study should also include a review of prior NRC reviews of HTGR designs and the conclusions from those reviews concerning the embedment feature of the technology on licensing considerations.

2. SCOPE AND ACTIVITIES TO BE PERFORMED:

2.1. Technical, Safety and Licensing Issues Influence on Containment Design

Prepare a list of the technical, safety and licensing issues that need to be addressed to develop the T&FRs for the HTGR containment and reactor building, including embedment. If there are issues that may affect only the NGNP as the demonstration plant for this technology, but not the HTGR as a commercial plant, these issues should be clearly delineated.

Review and document NRC regulations regarding release rates and design basis threats and hazards as they affect the containment and reactor building design.

Develop a cross-correlation of design features for the containment and reactor building, including embedment, against the technical, safety and licensing issues and the NRC regulations affecting the design. This activity should consider the following factors as a minimum:

- Pressure ranges for design basis and severe accidents loss of coolant events
- Containment effects on release rates
- Effects of air ingress on calculated dose rates (i.e., under postulated air ingress events) and the potential application of an inert atmosphere to reduce the effects
- Filtration and ventilation requirements
- Design basis threats and hazards effect on containment/reactor building structure and configuration
- With regard to embedment, impact on:
    - Affect on operations effects (Rx protection, access for refueling, etc.),
    - Reactor design,
    - Ultimate heat sink,
    - Site location, including consideration of geo-technical constraints, water tables, etc.
    - Construction complexity,
    - Cost,
    - Design basis threats and Natural Phenomenon Hazards (NPH),
    - Seismic performance/effects,
    - Others

These activities should consider the objective of minimizing the extent of the Exclusionary Area Boundary and the need for an Emergency Planning Zone.

Due to the preliminary nature of the design and technology development there may be insufficient data to fully characterize some of these factors. These shall be identified as areas requiring further development as the project progresses (see item 2.3).

2.2. Preliminary Technical & Functional Requirements

Develop a preliminary set of Technical & Functional requirements for the containment and reactor building, including embedment consistent with the results of the cross-correlation. As noted, because of the preliminary nature of the design and technology this set will not likely be complete. The missing or partially developed elements of the design should be clearly delineated.

2.3. Identify Potential Alternative Designs

Develop a preliminary set of alternative designs for the containment and reactor building including embedment for the NGNP assuming installation at the NPR site at INL. Rank these alternatives for use in commercial applications with site characteristics that represent the range of potential sites nationally and internationally.

2.3 Open Issues and Additional R&D and Engineering Studies

Prepare a summary of the technical, safety and licensing issues that need to be resolved to complete definition of the containment T&FRs and the R&D and engineering studies required to resolve them.

2.4. Prepare Report and Submit for Review and Comments

Prepare the report summarizing methods, results, conclusion and recommendations for review and comment.

2.5. Review and Incorporate Comments

Conduct an integrated review meeting with DOE, BEA/INL, stakeholders, etc. at the Contractor's site. Document and resolve all comments. Incorporate comments and prepare the report for issue.

3. MAJOR PRODUCTS AND DELIVERABLES:

3.1. Reactor Containment and Building, including Embedment Technical & Functional Requirements Development Report

3.1.1. Matrix of Technical/Safety issues affecting containment and reactor building, including embedment, design
3.1.2. Summary of containment and reactor building alternatives
3.1.3. Preliminary Technical and Functional Requirements
3.1.4. Summary of open issues and recommended R&D and Engineering studies required to resolve them

4. ESTIMATE DEVELOPMENT BASIS:

11.2 **Schedule: Subcontractor to prepare a schedule to meet the September 15, 2008 delivery date, see SOW section 1.3.2.1.**

11.3 **Cost Estimate Basis: Subcontractor to prepare**

5. MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS:

NA

6. ASSUMPTIONS: (Assumptions are expected to justify the scope and may assist in the basis for future review and approval of changes)

NA

7. RISKS:

NA

8. SUBCONTRACT STRATEGY:

NA

Appendix C

"Power Conversion System Alternatives and Selection Study"

[WBS.PCS.000.S01]

WBS Title:	**PCS Alternatives and Selection Study]**
WBS Element Code Level:	**PCS.000.S01**
Activity:	
Project Engineer:	**Sam Bader**
	Subcontractor Information

9. ELEMENT DESCRIPTION:

The objectives of this task are to:

- Confirm the Subcontractor recommendation in the NGNP Pre-Conceptual Design Report in FY07 for the configuration of the Power Conversion System
- Refine the estimates of performance and cost for the PCS configuration recommended for NGNP
- Evaluate the feasibility of applying a combined cycle configuration in an indirect heat transport configuration
- Identify configurations of the PCS that should be considered for commercial applications including, as a minimum, electric power production, co-generation and support of hydrogen production.

10. SCOPE AND ACTIVITIES TO BE PERFORMED:

1.1. Recommended Configuration for NGNP

Several alternatives were presented for the recommended configuration of the PCS during the pre-conceptual design work for NGNP in FY07. The Subcontractor shall either confirm the configuration recommended for NGNP or provide a revised recommendation for the configuration and, if it is revised, the justification for the revision. Any recommended configuration shall be compatible with the NGNP indirect heat transport configuration. Direct cycle configurations will not be considered for NGNP.

1.2. Cost and Performance for the Recommended Configuration

The Subcontractor shall provide for the configuration recommended for NGNP estimated costs and performance and estimates of the design readiness (DRL) and technology readiness (TRL) levels1 for the configuration. These estimates shall consider the following:

- The objective of initiating plant operation in 2018
- The potential that the plant will be initially operated at gas outlet temperatures in the 750°C to 850°C
- The principal that the design of the plant should not preclude operating with a reactor outlet temperature of up to 950°C

1.3. Evaluate the Combined Cycle Alternative

[1] The DRL and TRL shall be determined in accordance with the NGNP Project Procedure.

An indirect heat transport system configuration will be used in NGNP. The Subcontractor shall evaluate the feasibility of using a combined cycle PCS configuration in the secondary loop. This configuration would include a Brayton cycle turbine generator in the secondary loop with its exhaust feeding a steam generator that supplies a Rankine turbine generator. This evaluation should consider the use of compact and shell and tube design intermediate heat exchangers. The advantages and disadvantages of this configuration should be developed. The cost and performance and the DRL and TRL of feasible configurations should be estimated.

1.4. PCS Alternatives for Commercial Applications

The Subcontractor shall identify PCS configurations for potential commercial applications of the HTGR technology, including, as a minimum, electricity production, co-generation of electricity and steam or hot gas, hydrogen production. For each application provide estimates of:

- Configuration
- Performance including power level, product production rates, where appropriate, (e.g., steam flow rate and conditions), and overall power plant efficiency
- Cost
- Design Readiness and Technology Readiness Levels

1.5. Formal review

Prepare, present and conduct 50% and 90% reviews with BEA/INL and appropriate/selected stakeholders. These reviews will be either held at the Subcontractors site or by video- or tele-conference. Collect and resolve comments for preparation of the final report.

11. MAJOR PRODUCTS AND DELIVERABLES:

1.6. Report

A single report shall be prepared summarizing the work performed, alternatives considered, conclusions and recommendations for the four areas of investigation:

- Confirmation of the Recommended PCS Configuration for NGNP
- Cost and Performance Estimates for the Recommended Configuration
- Evaluation of a Combined Cycle Configuration
- Identification of PCS Configurations for Commercial Applications

12. ESTIMATE DEVELOPMENT BASIS:

1.7. Schedule: Subcontractor to prepare a schedule to meet the September 15, 2008 delivery date, see SOW section 1.3.2.1.

1.8. Cost Estimate Basis: Subcontractor to prepare.

13. MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS:

NA

14. ASSUMPTIONS:

NA

15. RISKS:

NA

16. SUBCONTRACT STRATEGY:

NA

Appendix D
(11) "Composites R&D Technical Issues Study"

[WBS HHS.000.S15]

WBS Title:	**Composites R&D Technical Issues**
WBS Element Code Level:	**NHS.000.S15**
Activity:	
Project Engineer:	**Doug S. Vandel**
Status	**Subcontractor Information**

1. ELEMENT DESCRIPTION

This study will identify the potential applications and design requirements for ceramic and ceramic composites in the HTGR primary system. (Note: in the following ceramic and ceramic composites refer to non-graphite materials.) Specifically, components that are anticipated to be fabricated from non-graphite ceramic and ceramic composites will be identified along with the operating conditions for normal and off-normal conditions (i.e. stress, temperature, fluence, atmospheric conditions, etc.). In addition, the activities necessary to codify these materials (e.g., in ASME and ASTM codes) will be identified along with any additional work anticipated to be required to support NRC licensing of the plant.

Discussions with the reactor vendors during the pre-conceptual design work in FY07 indicated that some in-core components may require the use of ceramic and ceramic (or carbon) composite materials to provide required material properties under high temperature and stress conditions. Examples of these components include fused silica foundation tiles supporting the graphite core, carbon felt blankets for insulation, and carbon fiber reinforced carbon (C/C) composites for insulation blanket hanger rods. This study will identify all currently known core components which may be candidates for use of ceramic composite materials.

It is understood that the components fall within two categories; structural components (i.e. hanger rods, tiles, belts, straps, etc.) and thermal insulators (i.e. felts, blankets, pads, etc.). Examples of candidate ceramic materials include alumina, zirconia, silica, and possibly carbide systems. Examples of candidate ceramic composites include fiber reinforced ceramic or carbon matrix composites such as carbon fiber-carbon matrix (C/C), Silicon carbide fiber – carbon matrix (SiC/C), and Silicon carbide fiber – Silicon carbide matrix (SiC/SiC). Examples of thermal insulators include carbon-carbon composites and potentially ceramic carbide fiber systems (i.e. SiC).

As part of this task the operating conditions that these components will be subjected to during normal and off-normal conditions will be specified to include as a minimum the temperature, anticipated stresses/loads, accumulative fluence, and the environment during operation.

The possibility of using composites for control rod applications has also been indicated for several NGNP designs. The operational conditions for the control rods should be determined and the ability to apply ceramic composites for this application for these conditions evaluated.

The objective of initiating operation of NGNP in 2018 shall be a factor in conducting this study.

1. SCOPE AND ACTIVITIES TO BE PERFORMED:

1.1. Identification of components

Identify reactor components likely to be fabricated from ceramic or ceramic-composite materials. Both structural as well as thermal insulating components in the core and primary coolant system shall be identified. This task shall include recommendations of the reactor vendors and others identified as part of the review of work performed by others.

1.2. Recommended operating conditions

Define the anticipated reactor conditions for each candidate composite or ceramic component. Conditions such as expected normal and off-normal temperature levels, operating time, fluence, applied loads (tensile or compressive), environment (i.e. oxidation or impurity levels), and other applicable parameters shall be determined. It is recognized that the designs are not complete and that some of these conditions may not be fully developed (i.e. oxidation/impurity levels) but it is expected that reasonable estimates shall be provided with the report. Operating conditions for control rods shall be provided with the report even if the composite material systems are not the first material choice for such an application.

1.3. Required Material Properties

Define the required dimensions and material properties of the candidate ceramic and composite components. This evaluation should summarize the applicable material properties such as thermal stability, thermal conductivity, strength values, creep, and other factors required to assess the viability of the composite and ceramic materials for normal operating conditions, anticipated transients, abnormal events and design basis events. This summary should cover at least the range of conditions identified in the NGNP Pre-Conceptual Design Report.

1.4. Anticipated codification requirements

Identify the necessary activities required to codify the selected materials (e.g., in the ASME and ASTM codes) and any additional work needed to support NRC licensing of the plant. This evaluation should summarize which activities will be required for NRC approval including testing development, determination of required material properties, and codification activities. An estimated timeline and costs for these activities shall be provided with the evaluation.

2. MAJOR PRODUCTS AND DELIVERABLES:

2.1. Identification of components

Included in the Individual Report from each of the reactor vendors

2.2. Recommended operating conditions

Included in the Individual Report from each of the reactor vendors

2.3. Required Material Properties

Included in the Individual Report from each of the reactor vendors

2.4. Anticipated codification requirements

Included in the Individual Report by from each of the reactor vendors

2.5. Recommendations

A comprehensive summary report prepared by each of the reactor vendors providing recommendations for ceramic and composite components including the bases for the recommendations. This report will include the information noted above.

3. ESTIMATE DEVELOPMENT BASIS:

3.1. Schedule: Subcontractor to prepare a schedule to meet the September 15, 2008 delivery date, see SOW section 1.3.2.1.

3.2. Cost Estimate Basis: Subcontractor to prepare

4. MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS:

NA

5. ASSUMPTIONS: (Assumptions are expected to justify the scope and may assist in the basis for future review and approval of changes)

NA

6. RISKS:

NA

7. SUBCONTRACT STRATEGY:

NA

Appendix E

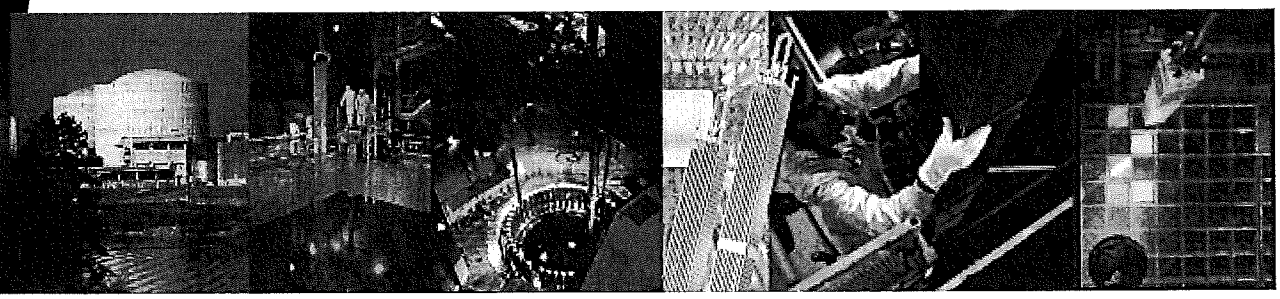
(10) "Review Recommendations from F&OR Study"

[WBS, NHS.000.S14]

Note: To be sent to AREVA at a later Date

Attachment 11.1

AREVA Approved Work Plan



Battelle Energy Alliance, LLC

Contract No. 00075310

Work Plan – Phase B

Conceptual Design Studies for

NGNP with Hydrogen Production

AREVA Federal Services LLC

May 6, 2008

AREVA

Work Plan Approval

Finis Southworth, AREVA NP Project Manager

Sam Bader, INL Project Engineer

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1.1 Introduction

During the Department of Energy's Next Generation Nuclear Plants (NGNP) Pre-Conceptual Design (PCD) work phase, including the several review meetings held between Idaho National Laboratory, Management & Operating Contractor, Battelle Energy Alliance, LLC (INL, M&O, BEA) NGNP Project Engineering and the subcontractor teams, several areas were identified for emphasis and further study in the conceptual design phase of design development. These were captured by the contractor teams and presented as recommended future studies in the PCD Reviews. NGNP Project Engineering extracted all of the recommended future studies from the reports for review and eventual incorporation into the conceptual design work scope. Approximately 100 study descriptions were extracted. In many cases, the subject, scope, and objectives of several studies were similar enough to permit consolidating them into a single study. This consolidation effort distilled the number of studies by about half (i.e., there are now about 50 uniquely defined future studies). NGNP Project Engineering then separated the studies into three categories:

- Technical Selection Studies – These studies need to be completed to support the selection of key parameters and technologies for the NGNP (e.g., reactor power, gas outlet temperature, IHX design and materials, RPV materials, and hydrogen plant). These have the highest priority since these decisions need to be made to begin the actual design of the plant.

- Design Development Studies – These studies address areas that will affect the actual design of the plant and critical systems and components (e.g., site selection within INL, design to facilitate construction, and design to support the initial proof-of-principle operating period). These have high priority since these areas need to be resolved to begin the actual design work.

- Other Studies – These studies cannot be initiated until the other higher-priority studies are completed since the nature of the study depends on the results of the prior studies and design selections.

The AREVA work plan is formulated to provide engineering services for the conceptual design activities for NGNP with high efficiency electricity production and process heat applications including a hydrogen production facility and is derived from the BEA Statement of Work (SOW 6175) that will initiate the conceptual design work to support the selection of key parameters and technologies for the NGNP.

AREVA has the overall project responsibility. Other key technical competencies needed for full execution of this and follow-on phases of the NGNP including final design, construction and operations work have been assembled within the AREVA NGNP Team that include Burns & Roe, Washington Group International, BWXT, Dominion Engineering, Praxair, Hamilton Sundstrand, Rocketdyne and Mitsubishi Heavy Industries (MHI).

AREVA NGNP Team members were selected to bring key technical competencies for the successful execution and completion of the pre-conceptual, conceptual and follow-on phases of this project. AREVA NGNP team members bring relevant experience and/or on-going R&D work needed to perform the conceptual design being proposed. This work plan capitalizes on the team members existing and ongoing R&D work to produce a high value conceptual design for the NGNP prototype facility. This will be executed within the constraints of strict and aggressive project schedule and project management principles.

1.2 Work Scope:

(See Appendix A for details of the below proposed work)

11.3.1 ***1.2.1 Reactor Containment, Embedment Depth & Building Functions, [WBS. NHS.000.S02]***

11.3.2 ***1.2.2 Power Conversion System Alternative and Selection Study, [WBS.PCS.000.S01]***

11.3.3 ***1.2.3 (Later) Component Test Facility Initial Conceptual Design Report, [WBS. CTF.000.PCD]***

11.3.4 ***1.2.4 (Later) Review Recommendations from F&OR Study, [WBS.NHS.000.S14]***

11.3.5 ***1.2.5 Composites R & D Technical Issues, (WBS.HHS.000.S15)***

11.3.6 ***1.2.6 (Later) Licensing Specification Development, [WBS.NHS.000.S16]***

11.3.7 ***1.2.7 (Later) Circulator Design/Isolation Valves, [WBS,HTS.000.S02]***

1.3 Performance of Work

11.3.8 ***1.3.1 Work Plan***

Develop and submit a work plan for the scope of work described in this document to complete the Conceptual Design Study/Report(s). The work plan shall detail and describe: all activities, organizational and staffing responsibilities for various tasks, work approach, manpower, activity estimates with cost proposal, subcontractor project organization and responsibilities, activity

definition work sheets and summary sheets, as well as overall plans and schedules for accomplishing individual tasks, major milestones and reporting requirements (See section 1.3.3.4 "Monthly Reporting" for further requirements). The work plan shall include a proposed schedule for all pertinent activities.

BEA will review the work plan and provide comments within 5 working days of receipt. Based on the input of BEA, the AREVA will develop a final work plan within 10 working days and conduct meetings with BEA to facilitate planning and final completion of the work plan. Notice to proceed with the work will not be given until the final work plan is approved by BEA.

Key Activities and Work Breakdown Structure

The proposed work plan consists of the key activities below:

- Finalization of the work plan;
- Execution of conceptual design studies;
- The overall project management, administration, reporting, and schedule. Copies of the WBS and spending profile are located in Appendix B and C.

Upon contract award, the work begins with finalizing this work plan followed by performing the proposed conceptual design studies. The list of proposed conceptual design studies and the schedule of their performance and completion is provided in Table 1.

Table 1: Conceptual Design Studies

Studies	Completion Date
1. Reactor Containment, Embedment Depth, and Building Functions	September 15, 2008
2. Power Conversion System Alternatives and Selection Study	September 15, 2008
3. Component Test Facility Initial Conceptual Design Report – Draft	(Later)
4. Review Recommendations from F&OR Study	(Later)
5. Composites R&D Technical Issues	September 15, 2008
6. Licensing Specification Development	(Later)
7. Circulator Design/Isolation Valves	(Later)

The key schedule milestones are listed below. These key milestones may not be changed without prior client approval.

Key Milestones

1.	Kick-off meeting for CTF ICD NGNP Technology Development Roadmap	May 8, 2008
2.	50% Design Review for RB/PCS/Composites	July 8-9, 2008
3.	Draft Reports for RB/PCS/Composites	August 20, 2008
4.	90% Design Review for RB/PCS/Composites	August 27-28, 2008
5.	Final Reports RB/PCS/Composites	September 15, 2008

Major project milestones are identified in the summary activity worksheets. Detailed activity worksheets correspond to WBS items and the schedule and resources allowed. The conceptual design studies report sections are linked to individual worksheet deliverable as a WBS item. Project tracking through the WBS and project schedule progress is used for earned value calculations. Only high level milestones will be shown in the WBS.

Project Deliverables

Project deliverables will consist of the following items as required by the Statement of Work:

- Design progress communication and correspondence
- Conceptual Design Studies/Reports

11.3.9 ***1.3.2 General***

All communication with BEA will be documented with copies sent to both the BEA Project Engineer and the AREVA Project Manager. The following reports, customer interfaces/meetings/interactions and other items as listed will be provided during the period of work execution as required by the Statement of Work. The AREVA NGNP Team Organization and Work Approach are discussed in Sections 1.4 and 1.5 respectively.

The Project Management will be responsible for executing the scope of work and ensuring that the following are accomplished.

11.3.10 ***1.3.3 Schedule***

Complete the Conceptual Design Studies no later than April 22, 2008. The preliminary study activities and schedules shown in Appendix A are provided only to reflect the expected level of detail. AREVA will manage the remaining schedule items to be completed within the framework of the key milestones. Schedule adjustments to any milestones – other than the four key milestones - can be made up to 30 days (plus or minus) without client approval.

1.3.3.1 Kickoff Meeting

A teleconference kickoff meeting with DOE and BEA will be conducted within 5 working days upon agreement of the scope of work for each of the four (4) studies, and to discuss the scope of work, background information, design basis and key assumptions.

1.3.3.2 Field Inspections

(Not Applicable)

1.3.3.3 Status Review

A schedule of monthly status meetings with BEA and weekly teleconference calls of subcontractor's key personnel (Project Manager, Project Engineer and appropriate discipline lead engineers) is provided in Appendix D. General items for the monthly status meetings are:

- Progress to date vs. the plan,
- Recovery plan for activities behind schedule,
- Status of staffing and job hour expenditures,
- Highlight of activities in the upcoming month,
- Support required from BEA,
- Schedule concerns and issues,
- To-date costs vs. the budget, cost trends, earned value, etc.

AREVA may propose, for approval by BEA, alternate or standard work processes and reporting methods that meet the intent of the stated schedule and cost reporting requirements. The proposed status meeting schedule is contained in the Work Plan, Appendix D. Status (shown as percent complete) of the tasks identified on the Work Task Summary Sheets will be presented at the status review meetings. Work-in-progress will be presented for interim review by BEA at these meetings.

1.3.3.4 Monthly Reporting

AREVA will report earned value monthly according to the following schedule:

Month	Actual Costs to:	Estimated Spending To:	Monthly Report Due:
April	April 30th	May 25th	May 7th
May	May 31st	June 22nd	June 9th
June	June 30th	July 20th	July 7th
July	July 31st	August 24th	August 7th
August	August 31st	September 22nd	September 8th
September	September 30th	October 23rd	October 7th
October	October 31st	November 21st	November 7th
November	November 31st	December 20th	December 8th

Monthly report shall include the reports from the subcontractor's earned value monthly reporting system, with this information summarized in the report. This information and estimated spending is required for BEA reporting into the DOE Project Information and Collection System (PICS).

Cost Performance Report

Item	Current Period							Cumulative to Date							At Completion		
	Budgeted Cost		Actual Cost	Variance				Budgeted Cost		Actual Cost	Variance						
	Work Scheduled	Work Performed	Work Performed	Schedule	SV%	Cost	CV%	Work Scheduled	Work Performed	Work Performed	Schedule	SV%	Cost	CV%	Budgeted	Latest Revised Estimate	Variance

Provide performance and estimate of future performance by calendar week.

Example for October Monthly Report due Nov. 7th
Oct Wk1 Actuals
Oct Wk2 Actuals
Oct Wk3 Actuals
Oct Wk4 Actuals
Oct Wk5 Actuals
October Total
Nov Wk1 Estimate
Nov Wk2 Estimate
Nov Wk3 Estimate

1.3.3.5 Meeting Minutes and Telephone Records

Meeting minutes and records of telephone conversations between BEA and AREVA personnel will be prepared by AREVA, regardless of who initiates the call. Copies of the meeting minutes and phone call records will be sent to BEA within three working days of the meeting or call.

1.3.3.6 Action Item List

An action item list will be maintained with individually numbered showing responsibilities and completion dates. The list shall be updated, identified with the current date and distributed within three working days after action items are added.

1.3.3.7 Key Assumptions List

A Key Assumptions List, Appendix E, will be developed and will be updated, highlighted to denote changes, dated with the current date and distributed within three working days after adding items to the list.

1.3.3.8 Equipment Lists

If applicable, an equipment list will be prepared for facility and process equipment for use in cost estimate preparation. Long lead procurement items and recommended quality levels on the equipment shall be identified as applicable.

1.3.3.9 90% Review

A presentation on the Studies/Reports to BEA reviewers will be made at the 90% point of project's completion of the Conceptual Design Studies/Reports. All comments received during the review shall be resolved and incorporated by prior to the submittal of the final Conceptual Design Studies/Reports. Comments and resolutions shall be documented and submitted for inclusion in the project files.

1.3.3.10 Performance Requirements

All key information and decisional statements or data used in the preparation of the Conceptual Design Study/Report and document quality assurance reviews and validation will be cited and referenced prior to submittal for review.

1.3.3.11 Future Actions List

A list of action items will be identified during the course of preparation of the study/reports that are not covered in this scope of work and that have not been previously identified, but which should be covered in future conceptual design studies.

1.4 AREVA NGNP Team Organization

AREVA, as the lead BEA NGNP contractor for this work scope, has the overall project responsibility. In support of the NGNP conceptual design work, AREVA has assembled a team of sub-contractor companies with the key technical competencies needed for full execution of this and follow-on phases of the NGNP project including final design, construction, and operations. The AREVA NGNP Team includes Burns & Roe, Washington Group International (WGI), BWXT, Dominion Engineering, Air Products, Hamilton Sundstrand, Rocketdyne and Mitsubishi Heavy Industries (MHI). The Responsibility Assignment Matrix for this project is shown below:

Table 2: Responsibility Assignment Matrix

Responsibility	Lead	Support
Work Plan	F. Southworth, AREVA NP	N/A
Conceptual Design Studies	L. Lommers, AREVA NP	
• Reactor Containment, Embedment Depth & Building Functions	F. Shahrokhi, AREVA NP	Burns & Roe
• Power Conversion System Alternatives and Selection Study	L. Lommers, AREVA NP	MHI, Rocketdyne
• Component Test Facility Initial Conceptual Design Report	(Later)	
• Review Recommendations from F&OR Study	(Later)	
• Composites R&D Technical Issues	B. Riou, AREVA NP	
• Licensing Specification Development	(Later)	

Responsibility	Lead	Support
• Circulator Design/Isolation Valves	(Later)	
Project Management	F. Southworth, AREVA NP	N/A

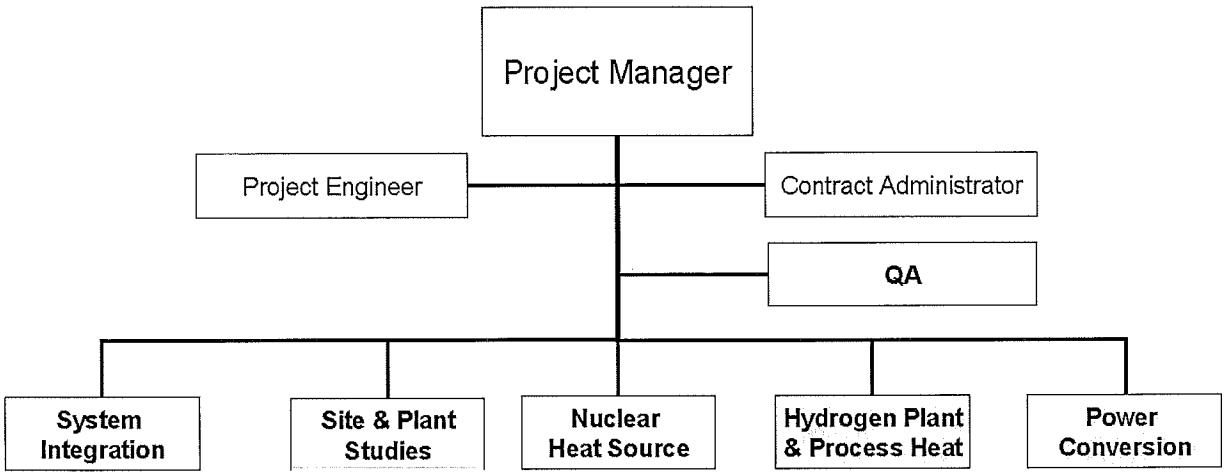


Figure 1: AREVA NGNP Functional Organization Chart

11.3.11 *1.4.1 Subcontractor Team Structure*

AREVA as the prime BEA contractor is supported by team members from a variety of industries with the necessary collective expertise to fully support the NGNP project. AREVA is the prime contractor for the AREVA NGNP team, and the other team members are subcontractors to AREVA.

Within AREVA, AREVA NP Inc. is supported by AREVA's global engineering and development organization. Support from technical experts in both France (AREVA NP SAS) and Germany (AREVA NP GmbH.) is anticipated. This support will also be provided via subcontract from AREVA NP Inc.

11.3.12 *1.4.2 Organizational Responsibilities*

As the prime BEA contractor AREVA has overall responsibility for execution of project. This includes management oversight, cost, schedule, etc., and technical oversight and coordination. Both the Project Manager and the Project Engineer are taken from AREVA.

With responsibility for the nuclear heat source and related work scope, AREVA will also perform a large fraction of the technical work in the project. AREVA will be assisted in its technical scope of work by AREVA NP SAS and AREVA NP GmbH. These components of AREVA have key expertise and resources that will be of clear value to the project.

Other AREVA NGNP team members have responsibility for specific work scope within their areas of expertise. The table below lists the main responsibilities for each organization within the AREVA NGNP team.

Table 3: AREVA NP Team Member Responsibilities

Company	Relevant Expertise
Air Products	Hydrogen Plant
Burns & Roe	Economic Studies and Support Systems
BWXT	Reactor Fuel (TRISO), Heavy Components
Dominion Engineering	Heat Transfer
Hamilton Sundstrand Rocketdyne	Power Conversion, Reactor Technology
WGI	Hydrogen Plant
MHI	Power Conversion, Hydrogen Plant
AREVA	Nuclear Island Reactor Technology, IHX, Main Circulator

11.3.13 ***1.4.3 Key Individual Responsibilities***

Project Manager (AREVA) – Finis Southworth – Oversight of Project Management (Cost, Schedule, etc.), Programmatic Customer Interface

Project Engineer – (AREVA) – Lewis Lommers – Technical coordination and direction of project.

11.3.14 ***1.4.4 Other Lead Individuals***

Project QA – (AREVA) – Jerome Ebner - Facilitate compliance with program Quality Assurance requirements, including interfacing with team member QA programs.

Technical Staff Leads – Oversee specific technical work scope within designated technical areas in compliance with budget and schedule requirements.

System Integration – Farshid Shahrokhi, AREVA

Nuclear Heat Source – Bernard Riou, AREVA

1.5 Work Approach

The general approach to perform the design of the NGNP with hydrogen generation as the lead prototype plant for next generation of nuclear power plants is to systematically perform key design studies for selection of the lead design, top level plant requirements, and to identify the necessary focused R&D to for design, build, license, and operate the prototype plant. The current Conceptual Design Studies will be completed within this framework.

The design of the NGNP as the energy source for electricity production and the potential driver for a demonstration hydrogen production facility requires assembly and integration of a variety of disciplines and development of system requirements through conduct of special trade studies and top level plant requirements management. These requirements have been captured during the pre-conceptual design work in a system requirements manual (SRM). The SRM will drive the lower level system requirements in the conceptual design activities.
Furthermore, based on experience in current design work done by AREVA and others for this reactor and hydrogen generation technology, certain materials and equipment must be developed and designed; this effort needs specific research and development requirements. The conceptual design work plan is designed to identify the required special R&D and it is tailored to focus on the type of R&D results needed.

AREVA work approach as discussed here brings together the overall competencies necessary to design the plant and its components, construct and obtain an operating license, and operate and maintain the plant. Lessons learned, equipment designed and construction techniques used in the course of this project will be used in the commercialization of this class of reactors and demonstration of the ability to produce hydrogen fuel on a commercial scale with a sustainable nuclear power cycle to drive the future economy of the United States. It is the goal of each member of the AREVA NGNP Team that, upon completion of the NGNP design, construction and operation of the plant, there would be adequate technology development underway that can support commercialization of such reactor type. The reactor could be used to generate electricity, or to provide process heat to a hydrogen plant or other industrial application of process heat.

Commercialization of any new technology must be driven by economics of the processes. The NGNP conceptual design economics and market evaluation will

provide valuable insights into the design such that the end product, i.e. hydrogen, process heat and electricity is produced with economic and market viability.

11.3.15 ***1.5.1 Systems Engineering Philosophy***

AREVA plans to use system engineering top-down requirements driven approach for the NGNP design activities. The system engineering philosophy has proven to be the key element of success in a complex design project with multiple participants and competing requirements. The process provides a structured framework for orderly requirements development and assessment based on functional analysis performed. The use of system engineering approach from the inception of this design and R&D identification project provides the important logic and documentation for design decisions made and therefore, establishes the required design bases of systems, structures and components, which must be maintained throughout the entire life cycle of the nuclear power plant.

11.3.16 ***1.5.2 Change Control***

AREVA has the responsibility to manage the project within the overall dollar limit. The budget can be transferred between individual activity data sheets up to $50,000 without client approval. The client will be notified when such transfers take place. These transfers will not create a project overrun. Any scope expansion beyond the original contract will have prior authorization by the client before work is started.

11.3.17 ***1.5.3 Technology Development Philosophy***

During this prototype design project certain R&D activities are required. During the course of this project three types of R&D needs will be identified and coordinated with the overall project completion schedule. The R&D needs will be categorized as a) developmental R&D, b) confirmation or characterization R&D, and c) qualification R&D.

The design process utilizing system-engineering tools complemented with a mechanism for capturing, categorizing, and prioritizing R&D needs. The prioritization process coordinates the R&D needs with the project phases. In addition, alternative success paths will be developed in case of high-risk R&D activities.

The timing for the R&D results is an important factor for the overall success of the project. Therefore, each R&D need will be coordinated with the overall completion schedule. Multiple levels of R&D needs and design options will be identified to minimize project risk and plant cost.

11.3.18 ***1.5.4 Use of Existing Internal Information***

AREVA and the team members of the AREVA NGNP design team possess key knowledge and competency required for successful execution of the project. Each member has significant amount of prior technical information or on-going R&D in various areas directly related to reactor and fuel design, hydrogen production, power generation, and related systems and components.

Each team member's prior technical knowledge (legacy information) can and will be used as appropriate in the preparation of the required design studies and pre-conceptual design work. A list of unique products and technologies developed by the AREVA NGNP team members that are directly usable for NGNP application includes:

Advanced Modular High Temperature Gas-cooled Reactor design work

Design and evaluation of a variety of compact intermediate heat exchangers (IHX) concepts

Fuel design and production (TRISO)

Materials testing and qualification (9 Cr steel)

HTR specific Neutronics and Thermo Hydraulic design code development and code qualification

Heavy component design and manufacturing capability and capacity
Thermo-Chemical hydrogen process development

Large helium isolation valves
Power conversion systems (PCS)

Existing documentation and historical data owned by each team member will not be directly transferred to the NGNP conceptual design project. All conceptual special studies and design work will be developed specifically for NGNP project. However, portions of the existing work that is judged technically applicable to the NGNP conceptual design may be recast for NGNP use.

It is the intention of each AREVA NGNP team member to retain the intellectual property (IP) rights of prior inventions or developmental work. Transfer of existing IPs to the BEA NGNP project, if required, will be identified and addressed on a case-by-case basis outside of the conceptual design studies project. No intellectual property rights are expected to be transferred during the conceptual design studies phase of the NGNP project.

11.3.19 1.5.5 QA and Configuration Management

The conceptual design quality assurance approach is tailored to the needs and anticipated schedule and budget constraints of this phase of the project. A project QA manual will be developed to specify the QA requirements for the AREVA NGNP project. The AREVA NP Inc. Quality Management Manual (Program) complies with 10 CFR 50, Appendix B.

As the Prime Contractor for the NGNP Project, AREVA will require all subcontractor companies to perform their work in accordance with the AREVA Quality Assurance (QA)

Program. AREVA procurement documents issued to those subcontractors will flow down the technical, quality, and special requirements of this project.

A Project Plan will be used to manage and control the technical, quality, and special requirements of this project. The Project Plan will describe contract objectives, including technical and schedule requirements. Project QA Plan (PQAP) will be developed for activities deemed "Quality Affecting" to augment the Project Plan for specifying the methods, controls, and procedures that are to be used to complete the scope of work by describing workscope details; deliverables; technical, quality, and special requirements; procedures to be used; software to be used; and external and internal interfaces.

AREVA design control process procedures, prescribed by the Project Plan or PQAP, will govern the preparation, review, approval, and issuance of all project conceptual designs, reports, and other deliverables.

Internal products are issued by each team member from their own configuration management system that will be in conformance with the project QA. Documents from other team members are imported into individual team member's configuration management system when necessary as external documents.
Formal project deliverables are issued from the guidance of the formal AREVA configuration management system.

11.3.20 ***1.5.6 Project Staffing and Resources***

The capability to provide the required project staffing and acquire the necessary resources for development and completion of initial design studies and preparation of conceptual design studies/reports was a key factor in the formation of the AREVA NGNP Team. AREVA has confirmed that each team member has the necessary experience and organizational depth to execute their assigned scope.

As outlined above regarding discussion of organizational responsibilities, each member of the AREVA NGNP team will be directly responsible for identification of specific experience and capability needed to accomplish the work scope assignment. Resource assignments will be based on required skills. Staff will not be relocated to a central facility due to the short project time frame and the need for maximum work production within the limited budget.

AREVA is experienced in managing projects with a dispersed workforce located in multiple locations. The most pertinent example is AREVA's commercial HTR design project, which is managed in this way. Efficient regular communication is facilitated by telephone, email, and telephone/video conferencing, reinforced by periodic face-to-face meetings.

For AREVA's portion of the scope of work, key staff will be made available from AREVA's commercial HTR program. This includes staff from each of AREVA's primary

operating regions (US, France, Germany). To facilitate effective communication with INL and BEA and to maximize work efficiency, the majority of the work will be performed in the US region.

Considering the limited schedule and budget of this Conceptual Design Study period, it is important to maximize the efficiency and minimize the impact of different time zones and long distance travel. However, in those areas where expertise from other regions is required it will be actively engaged. A proposed schedule for any necessary international travel will be provided at the Project Kickoff meeting. Similarly, existing staff at the worksites of other members of the AREVA NGNP team will support the project from their home offices.

In summary, AREVA has a strong base of experience managing projects with a widely dispersed workforce with the focus on supplying the best available expertise for each task in an efficient and cost effective manner.

Appendix A

Statement of Work

Project Title: Reactor Containment, Embedment Depth & Building Functions, WBS 1.3.4

WBS Title:	**Reactor Containment, Embedment Depth & Building Functions**
WBS Element Code Level:	**NHS.000.S02**
Activity:	
BEA Project Engineer:	**Sam Bader**
AREVA Lead Engineer:	**Farshid Shahrokhi**
Status	**Subcontractor information**

1.0 ELEMENT DESCRIPTION:

This study will support development of the technical and functional requirements for the NGNP and HTGR containment and reactor building, including embedment evaluation. This will include consideration of:

- NRC regulations and HTGR objectives regarding design basis release rates
- NRC regulations on design basis threats and hazards
- The need for a filtered containment, and, if needed, definition of the filtration requirements

This study shall be based on the current understanding of expected source terms for the HTGR technology. As such it is understood that this will be a scoping study helping to frame the issues associated with development of the T&FRs for the containment and reactor building. Accordingly, an objective of this study is to identify the issues and further R&D and engineering studies that are required to resolve these issues.

This study will develop the requirements and criteria for the need and the degree of embedment of the reactor building. This study will include embedment studies for the HTGR reactor building concepts, considering the interaction among factors that influence the depth of the embedment. These factors include cost, design basis threats, seismic effects, and hazards resistance. The results of this study will be used to characterize the interactions of these factors on embedment depths for commercial application of this technology. The recommendations from relevant sections of the Electric Power Research Institute (EPRI)'s *Advanced Light Water Reactor Utility Requirements Document* will be evaluated for applicability in this study. This phase of the study will include a review of prior NRC reviews of HTGR designs and the conclusions from those reviews concerning the embedment feature of the technology on licensing considerations.

2.0 SCOPE AND ACTIVITIES TO BE PERFORMED:

11.4 2.1 Technical, Safety and Licensing Issues Influence on Containment Design

List the technical, safety and licensing issues that need to be addressed to develop the T&FRs for the HTGR containment and reactor building, including embedment. If there are issues that may affect only the NGNP as the demonstration plant for this technology, but not the HTGR as a commercial plant, these issues will be clearly delineated.

Review and document NRC regulations regarding release rates and design basis threats and hazards as they affect the containment and reactor building design.

Develop a cross-correlation of design features for the containment and reactor building, including embedment, against the technical, safety and licensing issues and the NRC regulations affecting the design. This activity will consider the effect of the following factors associated with the available design details (no additional studies or design evaluations will be performed):

- Pressure ranges for design basis and severe accidents loss of coolant events
- Containment effects on release rates
- Effects of air ingress on calculated dose rates (i.e., under postulated air ingress events) and the potential application of an inert atmosphere to reduce the effects
- Filtration requirements
- Design basis threats and hazards effect on containment/reactor building structure and configuration
- With regard to embedment, impact on:
  - Affect on operations effects (Rx protection, access for refueling, etc.),
  - Reactor design,
  - Ultimate heat sink,
  - Site location, including consideration of geo-technical constraints, water tables,
  - Construction complexity,
  - Cost,
  - Design basis threats and Natural Phenomenon Hazards (NPH),
  - Seismic performance/effects

Any necessary design studies will be identified as potential open issues and or additional R&D.

These activities should consider the objective of minimizing the extent of the Exclusionary Area Boundary and the need for an Emergency Planning Zone.

Due to the preliminary nature of the design and technology development there may be insufficient data to fully characterize some of these factors. These shall be identified as areas requiring further development as the project progresses (see item 2.3).

11.5 **2.2 Preliminary Technical & Functional Requirements**

Develop a preliminary set of Technical & Functional requirements for the containment and reactor building, including embedment consistent with the results of the cross-correlation. As noted, because of the preliminary nature of the design and technology this set will not likely be complete. The missing or partially developed elements of the design should be clearly delineated.

11.6 **2.3 Identify Potential Alternative Designs**

Develop a preliminary set of alternative designs for the containment and reactor building including embedment for the NGNP assuming installation at the NPR site at INL. Rank these alternatives for use in commercial applications with site characteristics that represent the range of potential sites nationally and internationally.

11.7 **2.4 Open Issues and Additional R&D and Engineering Studies**

Prepare a summary of the technical, safety and licensing issues that need to be resolved to complete definition of the containment T&FRs and the R&D and engineering studies required to resolve them.

11.8 **2.5 Prepare Report and Submit for Review and Comments**

Prepare the report summarizing methods, results, conclusion and recommendations for review and comment.

11.9 **2.6 Review and Incorporate Comments**

Incorporate review comments into final report.

Prepare, present and conduct 50% and 90% review with BEA/INL and appropriate/ selected stakeholders. These reviews will be held either at the AREVA site or by video- or tele-conference. Collect and resolve comments for preparation of the final report.

12. 3.0 MAJOR PRODUCTS AND DELIVERABLES: A Final Report will be provided that summarizes the work performed in the following areas:

3.1 Reactor Containment and Building, including Embedment Technical & Functional Requirements Development Report

3.2 Matrix of Technical/Safety issues affecting containment and reactor building, including embedment, design

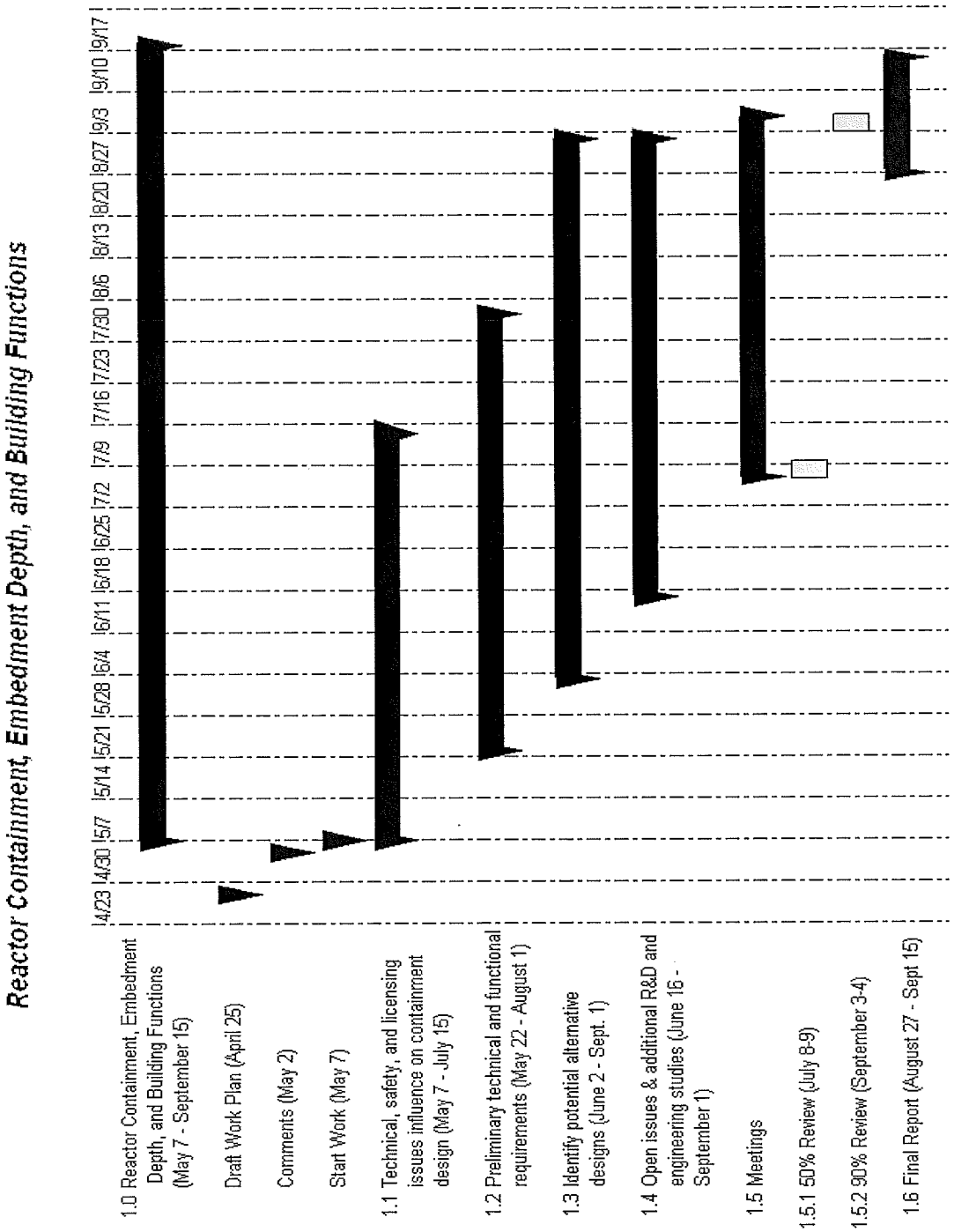
3.2.1 Summary of containment and reactor building alternatives

3.2.2 Preliminary Technical and Functional Requirements

3.2.3 Summary of open issued and recommended R&D and Engineering studies required to resolve them

4.0 ESTIMATE DEVELOPMENT BASIS:

12.1 4.1 Schedule



4.2 Cost Estimate Basis: $395,354

Task	Description	Estimated Effort (Hours)
2.1	Technical, Safety and Licensing Issues Influence on Containment Design	575
2.2	Preliminary Technical & Functional Requirements	455
2.3	Identify Potential Alternative Designs	825
2.4	Open Issues and Additional R&D and Engineering Studies	422
2.5	Prepare Report and Submit for Review and Comments	306
	TOTAL ESTIMATED HOURS	2,583
	Estimated Travel	$ 16,039
	Total Estimated Hours and Dollars	$395,354

13. 5.0 MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS:

N/A

14. 6.0 ASSUMPTIONS:

None

15. 7.0 RISKS:

N/A

16. 8.0 SUBCONTRACT STRATEGY:

BREI
AREVA NP

Project Title: Power Conversion System Alternatives and Selection Study, WBS 1.3.5

WBS Title:	**Power Conversion System Alternatives and Selection Study**
WBS Element Code Level:	**PCS.000.S01**
Activity:	
BEA Project Engineer:	**Sam Bader**
AREVA Lead Engineer:	**Lewis Lommers**
Status	**Subcontractor information**

1.0 ELEMENT DESCRIPTION

The objectives of this task are to:

- Update and confirm AREVA's recommendation in the NGNP Initial Design Report in FY07 for the configuration of the Power Conversion System
- Evaluate feasibility issues or concerns associated with recommended configuration(s).
- Refine the estimates of performance and cost for the PCS configuration recommended for NGNP
- Evaluate the feasibility of applying a combined cycle configuration in an indirect heat transfer configuration
- Identify configurations of the PCS that should be considered for commercial applications including, as a minimum, electric power production, co-generation and support of hydrogen production.

2.0 SCOPE AND ACTIVITIES TO BE PERFORMED

2.1 Recommended Configuration for NGNP

Several alternatives were presented for the recommended configurations of the PCS during the pre-conceptual design work for NGNP in FY07. AREVA will either confirm the configuration recommended for NGNP or provide a revised recommendation for the configuration and, if it is revised, the justification for the revision. Any recommended configuration shall be compatible with the NGNP indirect heat transport configuration. Direct cycle configurations will not be considered for NGNP (this does not preclude consideration of basic steam cycle with steam generator directly in primary circuit).

2.2 Cost and Performance for the Recommended Configuration

AREVA will provide for the configuration recommended for the NGNP estimated costs and performance and estimates of the design readiness (DRL) and technology readiness (TRL) levels[2] for the configuration. These estimates shall consider the following:

- The objective of initiating plant operation in 2018

[2] The DRL and TRL shall be determined in accordance with the NGNP Project Brochure.

- The potential that the plant will be initially operated at gas outlet temperatures in the 750°C to 850°C
- The principal that the design of the plant should not preclude operating with a reactor outlet temperature of up to 950°C

Evaluation of performance shall include indirect performance considerations such as reliability and safety concerns.

2.3 Evaluate the Combined Cycle Alternative

An indirect heat transport configuration will be used in NGNP. AREVA shall evaluate the feasibility of using a combined cycle PCS configuration in the secondary loop. This configuration would include a Brayton cycle turbine generator in the secondary loop with its exhaust feeding a steam generator that supplies a Rankine turbine generator. This evaluation should consider the use of compact and shell and tube design intermediate heat exchangers. The advantages and disadvantages of this configuration should be developed. The cost and performance and the DRL and TRL of feasible configurations should be estimated.

2.4 PCS Alternatives for Commercial Applications

AREVA will identify PCS configurations for potential commercial applications of the HTGR technology, including, as a minimum, electricity production, co-generation of electricity and steam or hot gas, hydrogen production. For each application provide estimates of:

- Configuration
- Performance including power level, product production rates, where appropriate, (e.g., steam flow rate and conditions), and overall power plant efficiency
- Cost
- Design Readiness and Technology Readiness Levels

2.5 Formal Review

Assemble and issue draft report.

Incorporate review comments into final report. Complete internal review of final report.

Issue final report for transmittal to customer.
Prepare, present and conduct 50% and 90% review with BEA/INL and appropriate/ selected stakeholders. These reviews will be held either at the AREVA site or by video- or tele-conference. Collect and resolve comments for preparation of the final report.

3.0 MAJOR PRODUCTS AND DELIVERABLES

3.1 Report

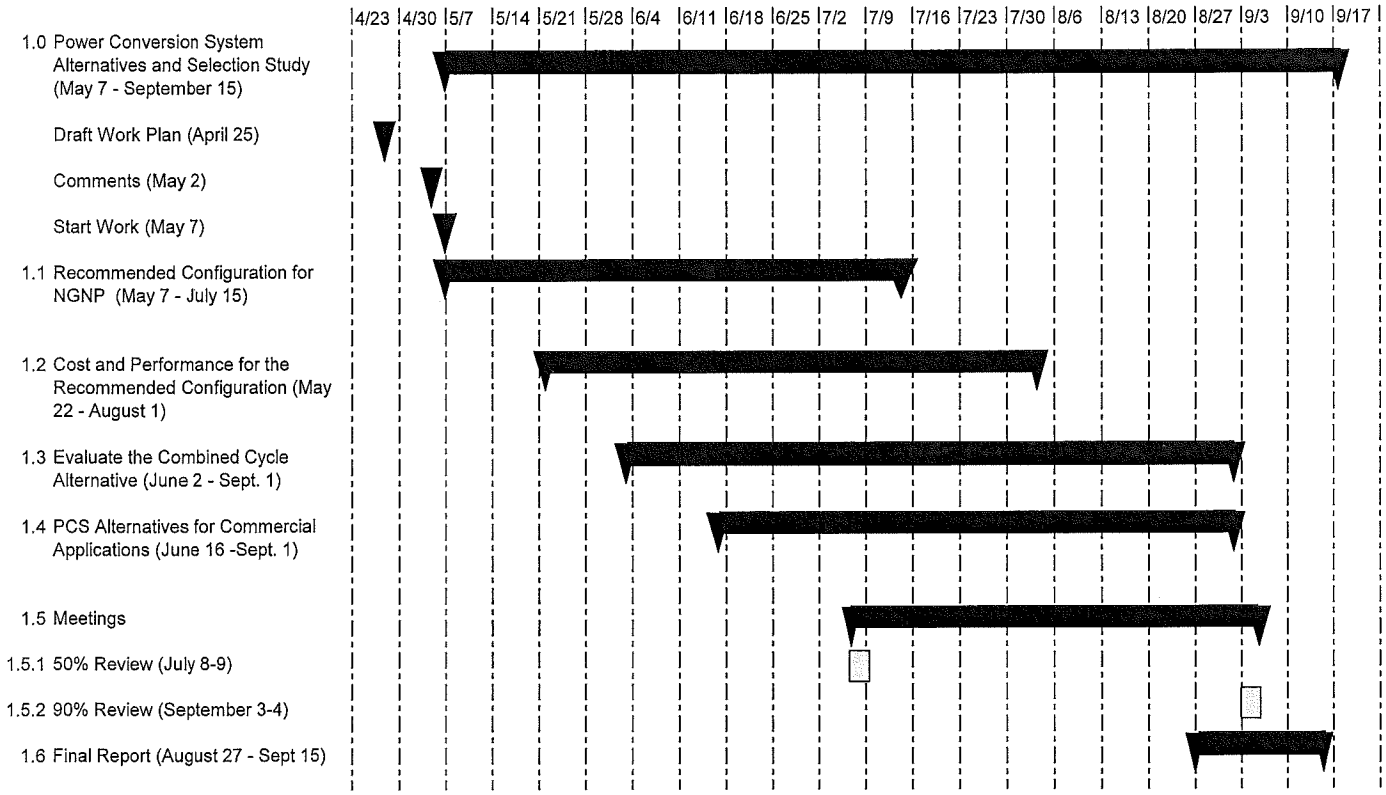
A single report shall be prepared summarizing the work performed, alternatives considered, conclusions and recommendations for the four areas of investigation:

- Confirmation of the Recommended PCS Configuration for NGNP
- Cost and Performance Estimates for the Recommended Configuration
- Evaluation of a Combined Cycle Configuration
- Identification of PCS Configurations for Commercial Applications

4.0 ESTIMATE DEVELOPMENT BASIS

17. Schedule

Power Conversion System Alternatives and Selection Study



18.

4.1 Cost Estimate Basis: $678,484

		Estimated

Task	Description	Effort (Hours)
2.1	Recommended Configuration for NGNP	888
2.2	Evaluate Recommended PCS Configuration	1,380
2.3	Evaluate CCGT PCS Configuration	858
2.4	Identify PCS Configuration for Commercial Application	560
2.5	Reports	288
	TOTAL ESTIMATED HOURS	3,974
	Estimated Travel	$ 30,000
	Total Estimated Hours and Dollars	$678,484

5.0 MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS

N/A

6.0 ASSUMPTIONS

N/A

7.0 RISKS

N/A

8.0 SUBCONTRACT STRATEGY

AREVA will lead this effort with the support of SLS-Rocketdyne, MHI, and BREI

Project Title: Composites R&D Technical Issues, WBS 1.3.6

WBS Title:	**Composites R&D Technical Issues**
WBS Element Code Level:	**NHS.000.S1 5**
Activity:	
BEA Project Engineer:	**Doug S. Vandel**
AREVA Lead Engineer:	**Bernard Riou**
Status	**Subcontractor information**

1.0 ELEMENT DESCRIPTION

This study will identify the potential applications and design requirements for ceramic and ceramic composites in the HTGR primary system. (Note: in the following ceramic and ceramic composites refer to non-graphite materials.) Specifically, components that are anticipated to be fabricated from non-graphite ceramic and ceramic composites will be identified along with the operating conditions for normal and off-normal conditions (i.e. stress, temperature, fluence, atmospheric conditions, etc.). In addition, the activities necessary to codify these materials (e.g., in ASME and ASTM codes) will be identified along with any additional work anticipated to be required to support NRC licensing of the plant.

It is understood that the components fall within two categories; structural components and thermal insulators. Examples of candidate ceramic materials include alumina, zirconia, silica, and possibly carbide systems. Examples of candidate ceramic composites include fiber reinforced ceramic or carbon matrix composites such as carbon fiber-carbon matrix (C/C), Silicon carbide fiber – carbon matrix (SiC/C), and Silicon carbide fiber – Silicon carbide matrix (SiC/SiC). Examples of thermal insulators include carbon-carbon composites and potentially ceramic carbide fiber systems (i.e. SiC).

This study will identify components which may be candidates for use of ceramic or ceramic composite materials. This will include in-core and out-of-core components of the Reactor Vessel (up to possibly the hot gas duct).

As part of this task the operating conditions that these components will be subjected to during normal and off-normal conditions will be specified to include as a minimum the temperature, anticipated stresses/loads, accumulative fluence, and the environment during operation.

The operational conditions for the control rods will be determined and the ability to apply ceramic composites for this application for these conditions evaluated.

The objective of initiating operation of NGNP in 2018 shall be a factor in conducting this study.

2.0 SCOPE AND ACTIVITIES TO BE PERFORMED

18.1 **2.1 Identification of components**

18.2 Identify reactor components likely to be fabricated from ceramic or ceramic-composite materials. Both structural as well as thermal insulating components in the Reactor Vessel (in-core and out-of-core) will be identified. This task will be based on the AREVA NGNP design, including a review of recommendations of other reactor vendors and others as applicable.

18.3 **2.2 Recommended operating conditions**

18.4 Define the anticipated reactor conditions for each candidate composite or ceramic component. Conditions such as expected normal and off-normal temperature levels, operating time, fluence, applied loads (tensile or compressive), environment (i.e. oxidation or impurity levels), and other applicable parameters shall be determined. It has to be recognized that the designs are not complete and that some of these conditions may not be fully developed but reasonable estimates will be provided with the report. Operating conditions for control rods will be provided as a part of this task.

Normal and off-normal temperatures will be estimated based on conservative CFD calculations on a limited number of situations. Conservative values of end of life fluences will be estimated based on one unique core configuration. For applied load evaluation, it is not foreseen to perform detailed finite element evaluation but the intent is to provide ROM stress estimates based on engineering judgment and hand calculations.

2.3 Required Material Properties

Define the required dimensions and material properties of the candidate ceramic and composite components. This evaluation should summarize the applicable material properties such as thermal stability, thermal conductivity, strength values, creep, and other factors required to assess the viability of the composite and ceramic materials for normal operating conditions, anticipated transients, abnormal events and design basis events. This summary should cover at least the range of conditions identified in the NGNP Pre-Conceptual Design Report.

2.4 Anticipated codification requirements

Identify the necessary activities required to codify the selected materials (e.g., in the ASME and ASTM codes) and any additional work needed to support NRC licensing of the plant. This evaluation should summarize which activities will be required for NRC approval including testing development, determination of required material properties, and codification activities. An estimated timeline and costs for these activities shall be provided with the evaluation.

3.0 MAJOR PRODUCTS AND DELIVERABLES: A comprehensive summary report that provides the following information:

A comprehensive summary report providing recommendations for ceramic and composite components including the bases for the recommendations. This report will include the following information:

3.1 Identification of components

3.2 Recommended operating conditions

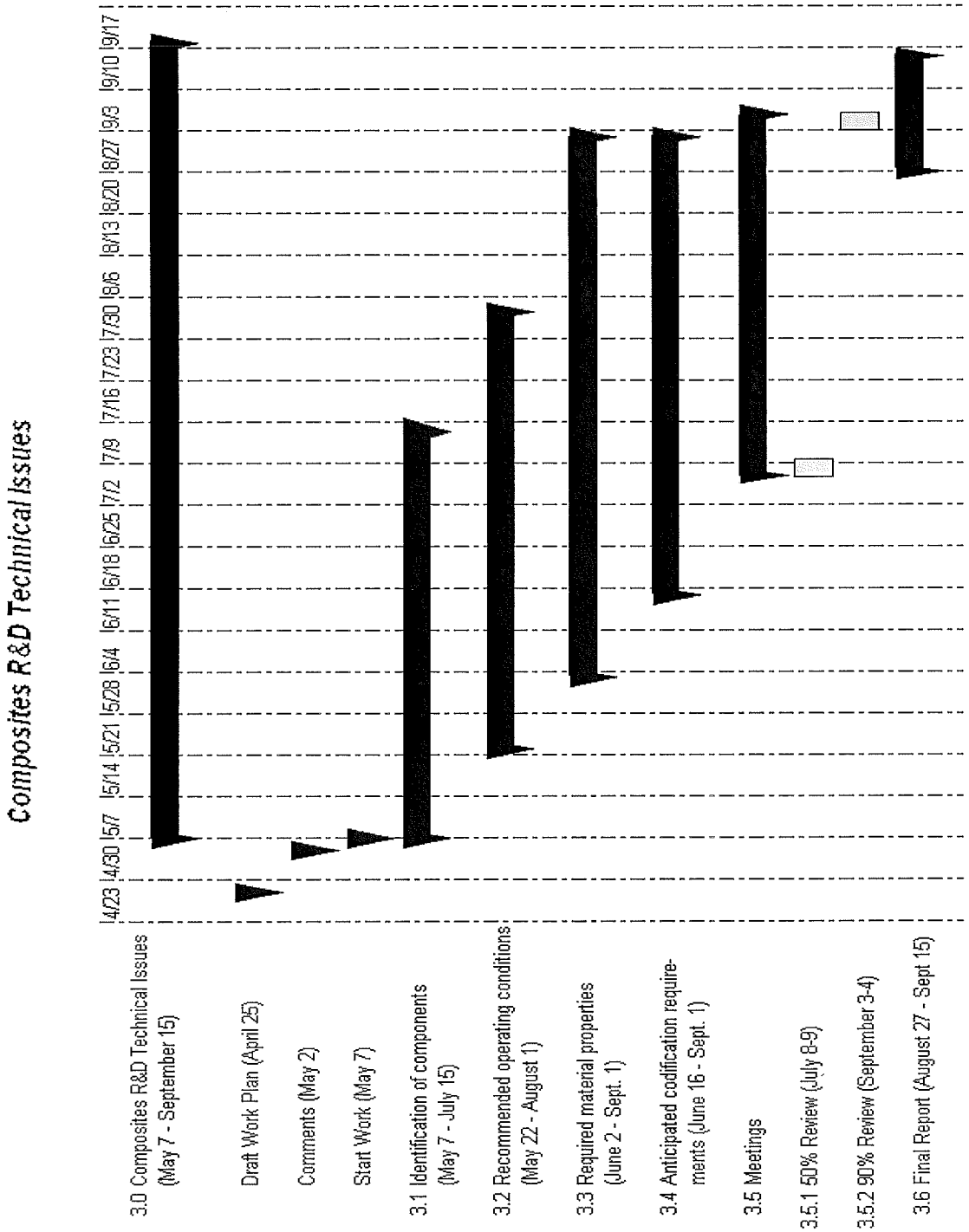
3.3 Required Material Properties

3.4 Anticipated codification requirements

3.5 Recommendations

4.0 ESTIMATE DEVELOPMENT BASIS

4.1 Schedule



4.2 Cost Estimate Basis: $322,954

Task	Description	Estimated Effort (Hours)
2.1	Identification of Components	180
2.2	Recommended Operating Conditions	1,144
2.3	Required Material Properties	450
2.4	Anticipated Codification Requirements	418
2.5	Meetings	192
2.6	Reports	260
	TOTAL ESTIMATED HOURS	2,644
	Estimated Travel	$ 0
	Total Estimated Hours and Dollars	$332,954

5.0 MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS

License for Attila

6.0 ASSUMPTIONS

N/A

7.0 RISKS

N/A

8.0 SUBCONTRACT STRATEGY

NovaTech
AREVA NP Inc.

Project Title: Conceptual Design Studies – Project Management, WBS 1.1

WBS Title:	**Conceptual Design Studies – Project Management**
WBS Element Code Level:	**PM**
Activity:	
BEA Project Engineer:	**Sam Bader**
AREVA Lead Engineer:	**Finis Southworth**
Status	**Draft SOW for AREVA NGNP Team**

1.0 ELEMENT DESCRIPTION:

This activity will provide overall project coordination and administrative support for execution of the conceptual design studies by the AREVA NGNP team.

2.0 SCOPE AND ACTIVITIES TO BE PERFORMED:

2.1 Project Coordination

- Provide overall coordination and oversight for the Conceptual Design Studies project.
- Ensure that project cost and schedule are followed.
- Interface with supporting resource organizations.
- Provide overall technical coordination and oversight.
- Maintain open communication with customer representatives.

2.2 Contract Administration

- Administer contract with INL/BEA for Conceptual Design Studies project.
- Administer contract with supporting AREVA NP team subcontractors.

2.3 Project Schedule

Develop and maintain AREVA NGNP Conceptual Design Studies project schedule.

2.4 Project Cost Analysis & Reporting

- Collect AREVA internal cost data and charges.
- Solicit subcontractors to obtain project charges.
- Calculate total project cost and charges.
- Analyze project costs and trends including variance analysis with respect to project budget.

2.5 Project Status Meetings & Minutes

- Conduct weekly status meetings with INL/BEA by telephone.
- Participate in monthly status meetings with INL/BEA.
- Issue meeting minutes from customer status meeting.
- Maintain action item list.

2.6 Quality Assurance

- Provide direct interface with AREVA Quality Assurance organization.
- Provide necessary review for issued products.

3.0 MAJOR PRODUCTS AND DELIVERABLES: A Final Report will be provided that summarizes the work performed in the following areas:

None. Products are produced under the individual studies.

4.0 ESTIMATE DEVELOPMENT BASIS:

4.1 Schedule

Not applicable

4.2 Cost Estimate Basis:

Task	Description	Estimated Effort (Hours)
2.1	Project Coordination	410
2.2	Contract Administration	330
2.3	Project Schedule	130
2.4	Project Cost Analysis & Reporting	130
2.5	Project Status Meetings & Minutes	150
2.6	Quality Assurance Plan & Assessment	50
	TOTAL ESTIMATED HOURS	1,200
	Estimated Travel	$ 8,560
	Total Estimated Hours and Dollars	$160,146

5.0 MATERIAL/EQUIPMENT/OTHER DIRECT COST REQUIREMENTS:

None

6.0 ASSUMPTIONS:

None

7.0 RISKS:

None

8.0 SUBCONTRACT STRATEGY:

AREVA will perform the project management for NGNP Conceptual Design Studies performed by the AREVA NGNP team.

Appendix B

WBS

WBS	Item Description	Lead Company
1	NGNP Conceptual Design Studies Project	
1.1	Conceptual Design Studies – Project Management	AREVA
1.2	Work Plan	AREVA
1.3	NGNP Design studies	
1.3.1	RPV and IHX Pressure Vessel Alternatives	AREVA
1.3.2	IHX and Secondary Heat Transport Loop Alternatives	AREVA
1.3.3	Characterization of the Effect of NGNP Operating Conditions on the Uncertainty of Meeting Project Schedule	AREVA
1.3.4	Reactor Containment, Embedment Depth & Building Functions	AREVA
1.3.5	Power Conversion System Alternatives and Selection Study	AREVA
1.3.6	Composites R&D Technical Issues	AREVA
1.4	AREVA Prismatic Reactor Fuel Study	AREVA
1.5	HTGR Component Test Facility (CTF) Recommendations	AREVA
1.5.1	CTF Recommendations – Needs, F&OR	AREVA
1.5.2	HTGR Component Concept, Cost, Schedule	AREVA
1.5.3	HTGR Component Test Facility ICDR	AREVA
1.6	Construction/Fabrication/Procurement	AREVA
1.6.1	Construction Techniques Study	AREVA

Appendix C

(LATER)

Appendix D

Schedule of Status and Progress Meetings

Weekly status update teleconference AREVA and key team members

Each Wednesday 11:00 a.m. Eastern / 9:00 a.m. Mountain

Status Meetings:

	Date	Format
May	May 22, 2008	Video Conference
June	June 19, 2008	Lynchburg
July	July 30, 2008	Video Conference
August	August 27, 2008	INL
September	September 17, 2008	Teleconference

Appendix E

Assumptions List

(LATER)

PROCUREMENT CHANGE NOTICE (PCN) – PART I

PART I

PO/Contract No.:	I/CR Number(s):	PCN No.:
75310	NA	05-07-08
Supplier: AREVA		
INL Originator: Sam Bader	Procurement Agent: Greg Anderson	

Requirement(s)/Subject:

The Subcontractor, under the provisions of the Blanket Master Contract (BMC), is to provide support to BEA in its planning to continue design developmement by performing further studies and preceeding with initial design activities.

Description of Change (Attach additional sheets/documents/references as required):

Effective this date, and in accordance with the changes provisions of the BMC, AREVA shall perform the work outlined in the attached Statement of Work, SOW-6306 Rev. 1, dated 05/07/2008. AREVA is authorized to incur costs for this work not to exceed $1,000,000.00. It is anticipated that this work shall be incorporated and included under Release No. 1 to the BMC No. 75310. NQA-1 is not applicable to this work.

JAC Sent *AREVA is only committed to the 3 studies: "Reactor Containment, Embedment Depth & Building Functions" [WBS.NHS.000.S02]; "Power Conversion System Alternatives and Selection Study" [WBS.PCS.000.S01]; and "Composites R&D Technical Issues" [WBS.HHS.000.S15].

TAC Sent *Add FAR 52.246-5, "Inspection of Services-Cost Reimbursement" and delete Clauses A7, "Inspection" and A19, "Warranty." (FAR 52.246-5 replaces A7)

TAC Sent *BEA is to address the SPES information in the release.

ACCEPTANCE

Supplier:	Procurement Agent:
Name: T.A. Coleman Date: May 29, 2008	Name: Greg Anderson Date: 05/08/2008
Signature: T.A. Coleman	Signature: R. G. Anderson 5/8/08
Negotiated Cost: TBD	Distribution: Procurement Administrative File (All); Technical Representative (All); Supply Chain Administration (QS Only); Program QE (QS Services Only); PSQ Engineer (QS Materials Only)
Delivery/Time Extension: N/A	
PO Rev/Contract Amend No.: TBD	
☒ Bilateral ☐ Unilateral	

Note: Reference Latest Procurement Document Change Control Procedure (Manual 4) for form use requirements